C. Begas

Alexander von Humboldt,

Author of "Cosmos."

London. D. Rogue 86 Fleet Street

THE

YEAR-BOOK OF FACTS

IN

Science and Art:

EXHIBITING

THE MOST IMPORTANT DISCOVERIES AND IMPROVEMENTS OF THE PAST YEAR,

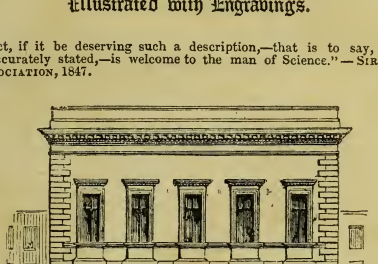
IN MECHANICS AND THE USEFUL ARTS; NATURAL PHILOSOPHY; ELECTRICITY; CHEMISTRY; ZOOLOGY AND BOTANY; GEOLOGY AND GEOGRAPHY; METEOROLOGY AND ASTRONOMY.

By JOHN TIMBS,

EDITOR OF "THE ARCANA OF SCIENCE AND ART."

Illustrated with Engravings.

"Every Fact, if it be deserving such a description,—that is to say, if it be truly observed, and accurately stated,—is welcome to the man of Science."—Sir R. H. Inglis Proc. Brit. Association, 1847.



New Museum of Economic Geology—Public Entrance.

LONDON:

DAVID BOGUE, FLEET STREET.

(LATE TILT AND BOGUE).

MDCCCXLVIII.

LONDON:

WILSON AND OGILVY, PRINTERS,

57, Skinner Street, Snowhill.

BARON HUMBOLDT.

(Frontispiece.)

From the Portrait by Von C. Begas.

The publication, within the past year, of the Second Volume of *Cosmos*, by Baron Alexander Von Humboldt, has suggested the selection of the Portrait of this distinguished *savant* for the Illustration of the present volume of records of contemporary Science.

Of Baron Humboldt it has been said, with equal truth and eloquence, that "he has devoted his life, in an especial manner, to the study of Terrestrial Philosophy. Not content with discharging the duties of a traveller, an observer, and *a collector of facts*, his philosophic mind was ever bent on the establishment of general laws; and it is to him that we owe the first generalizations regarding the temperature of the atmosphere and the earth—its magnetical condition, and those great features of our globe which mould its external form, and indicate its internal history. With an eye sharp for observation, and strained for induction, he has surveyed the regions of civilized Europe, the frozen steppes of Asia, and the burning plains of the American continent."*

"With the name of Humboldt," says another contemporary, "we associate all that is interesting in the Physical Sciences. No traveller who has visited the remote regions of the globe, for the purpose of observing the varied phenomena of nature, has added so much to our stock of positive knowledge. While the navigator has explored the coasts of unknown lands, discovered islands and shores, marked the depth of the sea, estimated the force of currents, and noted the more obvious traits of the countries at which he has touched; while the zoologist has investigated the multiplied forms of animal life, the botanist the diversified vegetation, the geologist the structure and relations of the rocky masses of which the exterior of the earth is composed; and while each has thus contributed to the illustration of the wonderful constitution of our planet," Humboldt "stands alone as uniting in himself a knowledge of all these sciences. Geography, meteorology, magnetism, the distribution of heat, the various departments of natural history, together with the affinities of races and languages, the history of nations, the political constitution of countries, statistics, commerce, and agriculture,—all have received accumulation and valuable additions from the exercise of his rare talents." †

The following is a *précis* of the life and labours of this illustrious philosopher.

Frederick Henry Alexander Von Humboldt was born at Berlin, on the 14th of September, 1769; so that he is now in his 79th year. He received his academic education at Götengen and Frankfort on the Oder. In 1790, he visited Holland and England, in company with Messrs. George Forster and Von Geuns; and in the same year published his first work, entitled "Observations on the Basalts of the Rhine." In 1791,

* W. Macgillivray, LL.D., F.R.S.E.
† North British Review, No. X.

he went to Freyburg to receive the instructions of the celebrated Werner, the founder of geological science. The results of some of his observations in the mines of that district were published in 1793, under the title of *Specimen Floræ Freibergiensis Subterraneæ.*

In 1792, he was appointed assessor of the Council of Mines at Berlin, and afterwards director-general of the mines of Baireuth and Anspach, in Franconia. In 1795, he visited Italy and Switzerland. At this period, the discoveries of Galvani particularly attracted his attention, and the results of his experiments on animal electricity were published in 1796, with notes by Professor Blumenbach. He went to Vienna in 1795, and there studied a fine collection of exotic plants, He travelled through Salzburg and Styria with the celebrated Von Buch. Accompanied by his brother, William Von Humboldt, and M. Fischer, he then visited Paris, where he formed an acquaintance with M. Aimé Bonpland, who afterwards became his associate in travel.

It was not, however, until the year 1799 that Humboldt and Bonpland left Spain, on their great expedition, a narrative of which has been published under the title of *Voyage aux Régions Equinoxiales du Nouveau Continent, pendant les années* 1799, 1800, 1801, 1802, *et* 1803. The translation of this work by Mrs. Williams is familiar to the English reader. The various works relating to the journey, however, extend to 17 folio and 11 quarto volumes, with magnificent illustrations. The results of this expedition have been of the highest importance to science: in natural history, especially, this observation of six years exceeds anything that has been presented by the most successful cultivators of the same field during a whole lifetime. Our travellers brought with them an herbarium of more than 6000 species of plants; and the valuable works on this subject, which have appeared in consequence of the journey to America, form an era in the history of botany. The authors returned to Europe in 1804; but the labour of reducing their observations, and the publication of the several works, occupied many years.

In 1818, Humboldt visited London; and, in the same year, the King of Prussia granted him an annual pension of 12,000 dollars, with the view of facilitating a plan which he had formed of visiting Asia. In 1822, he accompanied his majesty to the congress of Verona, and afterwards visited Venice, Rome, and Naples; and in 1827 and 1828, delivered at Berlin a course of lectures on the physical constitution of the globe, which was attended by the royal family and the court. But, excepting the results of his investigations, which have appeared at intervals, we have no particular account of his occupations until 1829, when he undertook another important journey to the Uralian Mountains, the frontiers of China, and the Caspian Sea. On his return, he published a brief account of his researches; and a new edition being called for, he resolved to publish it as a new work, embracing materials which he had been collecting for twelve years, together with his corrected and enlarged views of Asiatic geology. This work has appeared under the title of *Asie Centrale; Recherches sur les Chaines de Montagnes et la Climatologie comparée*, (Paris, 1843); an excellent paper on which will be found in the *North British Review*, No. X.

In this work Humboldt has confined himself to the subject of terrestrial physics; in explanation of which he says, "as I still cherished the hope of publishing a very general work under the imprudent title of *Cosmos*."

The first volume of this valuable contribution to physical science was published in 1845; and a few of its most striking passages were quoted in the *Year-book of Facts*, 1846, pp. 132 to 136. During the past year, (1847,) the Second Volume has appeared; and a Translation, by desire of the Author, is now in the course of publication, under the superintendence of Lieut.-Col. E. Sabine, R.A., For. Sec. R.S. The first volume presents the principal results of observations, in the form of which, stripped of all additions derived from the imagination, they belong to a purely scientific description of nature. In the second volume is considered "the impression which the image received by the external senses produces on the feelings, and on the poetic and imaginative faculties of mankind. An inward world here opens to the view, into which we desire to penetrate, not, however, for the purpose of investigating—as would be required if the philosophy of art were our aim, what in æsthetic performances belongs essentially to the powers and dispositions of the mind, and what to the particular direction of the intellectual activity,—but that we may trace the sources of that animated contemplation which enhances a genuine enjoyment of nature, and discover the particular causes which, in modern times especially, have so powerfully promoted, through the medium of the imagination, a predilection for the study of nature, and for the undertaking of distant voyages." In fine, with this volume, the author passes from the domain of objects to that of sensations.

To conclude—in the words of Dr. Macgillivray, "any formal eulogy on our illustrious author must be altogether unnecessary, for his renown has extended over all parts of the civilized world; and, at the present day, there is not a man of science in Europe whose name is more familiar. Long after his career shall have terminated, he will be remembered as one of the chief ornaments of an age peculiarly remarkable in the history of the world."*

* Travels and Researches of Alexander Von Humboldt. (Edinburgh Cabinet Library.)

THE NEW MUSEUM OF ECONOMIC GEOLOGY.

(Vignette.)

This edifice, one of the noblest designs appropriated for a Scientific Institution, is now building: the architect is Mr. Pennethorne, and the style Italian. Its principal front will be in Piccadilly, a little to the east of St. James's Church, and on the same side of the street. The building will extend quite through to Jermyn Street, where its other, or south front, will face. This (engraved in the title-page) will be the public entrance; the entrance for the Establishment will be in Piccadilly. The plan contains a large hall for marbles, fossils, &c.; a lecture-theatre, and library; a large room, with galleries; small rooms, or cabinets, for mining models, chemical preparations, &c.; a Mining Record Office; laboratories for experimental mineralogy, &c.

CONTENTS.

THE

YEAR-BOOK OF FACTS.

Mechanical and Useful Arts.

NEW ORDNANCE SURVEY OF LONDON.

THE appointment of a Metropolitan Commission of Sewers is one of the most important Government measures of the last year, in furtherance of "The Health of Towns."

Already there has been presented to the Commission, a Report from Sir H. de la Beche and Mr. Chadwick, on a proposed Ordnance Survey of the Metropolis. This document recommends that there be prepared a block plan of London, and of the suburban districts, included within a radius of eight miles from St. Paul's: the said plan to contain a proper system of levels, for drainage and other purposes, recorded in convenient situations by a sufficient number of permanent bench-marks.

This Survey has been commenced under the direction of the Board of Ordnance. The importance of system in laying down drains at proper levels cannot be too strongly enforced. Mr. Chadwick states, that, from the want of this system in the Holborn and Finsbury divisions, £260,000 will be required to remedy the evil, which will make that amount almost thrown away. The Commission have, in forming the Survey, the assistance and co-operation of Sir H. de la Beche, who, being thoroughly conversant with the subjects of geological strata, the nature of springs, &c, a great deal of new matter will, for the first time, be introduced into a Survey of this description.

THE DOUBLE-ACTION PRINTING-MACHINE.

MR. WILLIAM LITTLE, the inventor and patentee of this novelty, (detailed in the *Year-book of Facts*, 1847, p. 39,) has since adapted the principle to a perfecting machine.

The success of this invention, demonstrated in the first trial with the beautiful working model, has been definitively proved in the machine itself. One of these machines has been constructed by Mr. Lewis Forster with such precision that the *first sheet* passed through it, (Jan. 22d, 1848,) came out a perfect impression—beautifully printed! It will be employed for printing the *London Telegraph*,—a new daily newspaper, whose novel source of information will be the Electric Telegraph; so that the means and the end will present a rare conjunction of scientific success.*

* Our readers will recollect the success of the working model of the Double-action Printing Machine, described in our last *Year-book*: the success of the large machine itself has even been more complete.

ART MANUFACTURES

Is THE name given to a series of British manufactures commenced in the last year; the object of which is to connect the best Art and the best Manufactures, and thereby raise the standard of general design, and of general taste, throughout all classes of the people. The suggestions, as well as the practical carrying out of the scheme, originated with a gentleman, who, under the name of "Felix Summerly," has written or edited several popular works, more or less of an artistic character—such as a collection called the "Home Treasury," the object of which was to beget a taste for beauty in children, in which, for the first time, he induced Artists of the highest repute to aid in making the pictures for such books. The Prospectus of the Art Manufactures explains fully the scope and the names of the principal parties engaged in producing them. After observing that the old mediæval artists—Francesco Francia, Lionardo da Vinci, Raffaelle, Holbein, Albert Durer, and many others, employed themselves in connecting the best Art with objects of utility in every-day use, the Projector promises that a revival of the practice shall take place.

"Manufacturing skill," he says, "is pre-eminent and abounds; but artistic skill has to be wedded with it. This defect was early observed by the Society of Arts, and by their exhibition of manufactures and distribution of premiums, they have in part attempted the remedy. It is the purpose of this Collection to carry out the same object to a still greater extent, and to revive the good old practice of connecting the best art with familiar objects in daily use. In doing this, Art Manufactures will aim to produce in each article superior utility, which is not to be sacrificed to ornament: to select pure forms: to decorate each article with appropriate details relating to its use, and to obtain these details as directly as possible from Nature. These principles are by no means put forward as forming an universal rule; but it is thought they may be adhered to advantageously in most articles of use, and may possibly contain the germs of a style which England of the nineteenth century may call its own. Several of our best artists have already expressed their willingness to assist in this object; among them may be named—

John Absolon; John Bell, sculptor; C. W. Cope, A.R.A.; T. Creswick, A.R.A.; W. Dyce, A.R.A.; J. R. Herbert, R.A.; J. C. Horsley, a Professor of the School of Design; S. Joseph, sculptor; D. Maclise, R.A.; W. Mulready, R.A.; R. Redgrave, A.R.A.; H. J. Townsend, a Professor of the School of Design; Sir R. Westmacott, R.A., &c. &c."

It is purposed that the Art Manufactures shall be of all kinds, and executed in metals, pottery, glass, wood, papier maché, ivory, and other materials. It is announced that arrangements have been already made with the following Manufacturing Firms, for executing Designs:—

I. F. Christy and Co., glass; the Coalbrookdale Iron Company; Creswicks, whitesmiths; Dixon and Sons, Britannia metal; Hunt and Roskill, precious metals; Jennens and Bettridge, papier maché; Leuchars, buhlwork; Messengers and Co., brass casting; Minton and Co., pottery; Richardsons, glass; Rodgers and Sons, cutlery; Simpson, paper hanging; B. Smith, precious metals; Stuart and Smith, iron casting; Taylor, Williams, and Jordan, machine carving; C. White, stone pottery; Wedgewoods, pottery; Willock and Co., Terra Cotta Works, &c. &c.

In addition to what has been detailed, it is purposed to extend the scheme to Textile Manufactures and Block Printing for fabrics of various kinds. But the introduction of better art is not the only object: Art Manufactures will cause new combinations of materials to be made in many ways: and the potter and the smith are already united usefully. A very beautiful material, called Parian, has recently been brought to great perfection by Messrs. Minton, the potters, of Stoke-on-Trent. It has the texture and look of the finest marble—and hence its name; but it is superior to marble in respect of its hardness and susceptibility of being perfectly cleaned. The chief ingredients in its manufacture are the finest disintegrated felspar and silex. Casts of great delicacy can be taken in a liquid state; they are then subjected to two separate and intense firings, during which process the material shrinks nearly one-fourth from its size when the cast was first made. At present there is great risk in the firing, and it is difficult to fire, with any certainty, articles of a greater size than 18 inches long. Several works have been produced in this material—the "Una and the Lion," and the "Dorothea," by John Bell, sculptor. It is susceptible of infinite combination with metals. The knob of a metal teapot, in Art Manufactures, is in Parian: handles of knives, too, are announced. Thus a work of sculpture, almost rivalling ivory in its look, is produced at a cost certainly less than a twentieth part that of ivory. In Glass many novelties are being attempted, especially in the enamelling processes, which were almost forbidden by the old Excise laws. Works in glass may be said to be in their infancy at present; but the double-handled vase, which has been executed in the Art Manufactures, shows how great difficulties may be conquered. This, owing to its double handles, each of which must be attached whilst the vase and handles are both of them in a fused state, and to the number of firings the vase must undergo, we believe is one of the most difficult glass articles which has ever been made in England. Electrotyping will come greatly in aid of these Art Manufactures, and several works are announced which will be executed by the process. Some bronzes have been produced: in these the great difficulty is to find the Artist workman; but when it is remembered that twenty years ago Paris had scarcely a bronzist, and now employs upwards of six thousand, we can have no doubts that the difficulty will be eventually conquered. The ancient Niello-work is to be revived. In short, if the scheme be prosecuted, (and its success promises that it shall be), it will mark an epoch of Art in England.*

TWENTY-ONE YEARS' RETROSPECT OF THE RAILWAY SYSTEM.

THE greatest speed of Trevithick's Engine was five miles an hour. The ordinary speed of George Stephenson's Killingworth Engine, in 1814, was four miles an hour. In 1825, Mr. Wood, in his work on railways, takes the standard at 6 miles an hour, drawing forty tons on a level; and so confident was he that he had gauged the power of the locomotive, that he thinks it right to say, "that nothing could do more harm towards the

* There has been a kindred movement in the Society of Arts, at whose house, in the Adelphi, a very interesting exhibition of specimens was given last session.

adoption of railways than the promulgation of such nonsense, as that we shall see locomotive engines travelling at the rate of 12, 16, 18, and 20 miles an hour." The promulgator of such nonsense was George Stephenson. In 1829, it was estimated that at 15 miles an hour the gross load was nine tons and a half, and the the net load very little, and that, therefore, high speed if attainable was practically useless. Before the end of that year, George Stephenson got with the Rocket a speed of 29½ miles per hour, carrying a net load of 9½ tons. In 1831 his engines were able to draw 90 tons on a level at 20 miles an hour.

When the speed of the locomotive was set beyond question, prejudice then took alarm about the safety, and a very strong stand has, from time to time, been made for a limitation of speed. Within the last seven years the London and Birmingham directors considered 20 miles an hour was enough, and had they been free from competition and supported by public opinion, they would, no doubt, have adhered to that rate, from the conscientious conviction that a higher speed was incompatible with economy and safety. The vigour of the broad-gauge advocates, and the necessity for proving the capabilities of their system, have led them to push on the march of improvement with energy, and the narrow gauge lines have been forced to follow. Thus the enterprise of directors and the ingenuity of engineers have been kept on the stretch to carry on the rivalry; and we consider the broad gauge as valuable, if on no other ground, that it has tripled the working-power of the locomotive, and given us 60 miles an hour, where we should have been lingering at 20. We recollect the simple unbelief, when it was announced that Brunel had run a locomotive at the rate of a mile a minute, and when at length it was known to be true, it was said that it was not safe, and would never do, and yet it has since then been made a working speed.

Thirty miles an hour was thought progress—an express at 35 miles an hour seemed to have reached the furthest limits—but, in 1846, Brunel succeeded in working the express to Bristol in two hours and a half, and to Exeter in four hours. Mr. M'Connell, the new locomotive superintendent of the London and North Western, has determined that the narrow gauge shall not be behind, and he has an engine building to carry the express train between London and Birmingham, in two hours, and we believe he will do it.

Trevithick's greatest net load was 10 tons, that of Stephenson's first engine 30 tons. In 1825, the net load was 40 tons, in 1831, 90 tons, now 1,200 tons.

These greater effects of the locomotive have been caused by an increase in the size of the parts, and a greater effective power. Trevithick's cylinder was 8 inches in diameter, and he had only one cylinder. Brunton's cylinder was 6 inches diameter. Stephenson's first locomotive had two cylinders, each of 8 inches diameter. In 1829, the Rocket had two cylinders, each of 1 inch diameter. The Sans Pareil had two cylinders, each of 7 inches in diameter; in 1831 the cylinders were enlarged to 10 ins. and 12 ins. diameter. In 1832, the Sampson, a powerful engine, had cylinders of 14 ins. diameter. Since then cylinders have been increased to 15 ins. and 18 ins. diameter, as in the Great Western locomotive.

The immense increase of power may be inferred from these measurements.

In 1829, the heating surface was about 100 square feet. It was soon increased to 200 square feet, and then to 300 square feet, afterwards to 400 square feet, 500 square feet, 600 square feet, 800 square feet, 1,000 square feet, and Mr. M'Connell promises to increase it. The fire-box surface in the Rocket was 20 square feet, in the broad gauge engines it has been increased to above 100 square feet.

The weights of the engines have necessarily increased. Brunton's leg locomotive, in 1813, weighed 2½ tons. In 1825, engines weighed 5 tons, but some with the tender weighed 10 tons. In 1829, the Rocket weighed 4½ tons, the tender 3 tons 4 cwt., the total being under 7½ tons. The weight of the engine has been increased to 8 tons, 10 tons, 12 tons, and so up to the Leviathan engine of 29 tons, on the Great Western.

The rails have become heavier with the weights of the engines. On the Stockton and Darlington, in 1821, they were not more than 28 lbs. to the yard. On the Liverpool and Manchester, in 1829, they were laid down at 35lbs. to the yard. They were successively increased to 50lbs. and 65lbs. The London and Birmingham was originally intended for rails of 64lbs. to the yard; but on Mr. Barlow's report, they were increased to 75lbs.; since then rails of 85lbs. to the yard have been laid down on some lines.

On the other hand, the consumption of fuel has diminished. Before 1829, the consumption of fuel was about 5lbs. to carry one ton a mile; in that year George Stephenson reduced it to 2·41 lbs. of coke. It would scarcely be credited, that it can now be brought to less than a quarter of a pound per ton per mile.

The gradients overcome have been steeper. Less than ten years ago, a gradient of one in one hundred and fifty was considered as impassable, except by means of a stationary engine. A gradient of one in thirty-seven can now be managed with the locomotive.

The effect of these enormous changes has been to give the country a very great saving in the charges for carrying, to say nothing about the time. The rates for goods have in many cases been reduced one-half, in some cases even to a greater extent; while there is a tendency in the progress of the railway system to a greater reduction.

To show, in a clearer light, the difference between railways and locomotives in 1804, 1822, and 1846, we have drawn up the following comparisons:—

1804	weight of rails	28lbs.	weight of engine	——	
1829	,,	35lbs.	,,	4¾	tons
1846	,,	85lbs.	,,	29	tons
		miles.			miles.
1804	highest speed	5 per hour,	working speed	2½	
1829	,,	29½	,,	10	
1846	,,	75	,,	55	
		ins.			tons.
1804	diameter of cylinder	8	greatest net load	9	
1829	,,	8	,,	40	
1846	,,	18	,,	1200	
1829	fire-box surface	20 sq. ft.,	heating do.	117	ft.
1846		108	,,	1000	,,

The great object in these remarks has been to show the progressive nature of the railway system, the danger which arises from rash conclusions, and the necessity for caution in prejudging the course of improvement. To sanction novelties may be injurious; but not to prejudge novelties is only prudence. The former savours of quackery; to put down novel inventions on the score of prejudice betokens ignorance, and the latter is the more prejudicial.

[We quote this valuable synopsis from Mr. Hyde Clarke's *Monthly Railway Register*.]

AMERICAN RAILWAYS.

A PAPER has been read to the Institution of Civil Engineers, by Mr. W. E. Newton, describing the method employed by Mr. Herron for the construction of the permanent way of the Philadelphia and Reading, and other Railways in the United States. The method was a deviation both from the systems of the longitudinal and the transverse sleepers: it consisted of two series of diagonal sleepers, crossing each other, and spiked together at the intersections with wooden trenails or iron pins, according to circumstances, forming an extended platform, upon which their longitudinal bearers were laid, supporting bridge-shaped rails, with wrought iron chairs. The paper entered minutely into the modes of construction, the dimensions of the various parts, and the expense of laying the road, with the ballasting. It then gave an account of several deviations from the general system, such as making the trellis work of iron laid in bitumen, &c., and also a detail of the amount of traffic conveyed along the railway; whence it appeared that within one year and five days from its being opened for general use, one million four hundred thousand tons of goods had been conveyed along it, without any prejudicial effect, and in fact with less wear and tear than was usual upon railways in the States. The cost of a single line of permanent way was about £850 per mile.

From the discussion that ensued, it appeared to be the opinion that although the system might succeed in a country where timber abounded, it was inapplicable for English railroads; and exceptions were taken to the general features of the construction for high speed—as the rails, which weighed only forty-four pounds per yard, and of a single bridge form, could not resist the impact of the wheels at great velocities—the junctions of the diagonally laid sleepers would become loosened, and there would be too much deflection between the bearing points. These objections were strongly urged, and were received as valid; but at the same time it was admitted, that it was extremely desirable to encourage the communication of accounts of foreign engineering works; and the thanks of the meeting were voted to Mr. Newton for the statements he had given, with a request that he would communicate to Mr. Herron this feeling of his English scientific brethren of the profession of civil engineering.

CLARKE AND VARLEY'S RESILIENT ATMOSPHERIC RAILWAY.

THE inventors of this Railway have laid down, on the grounds of the Blackwall Railway Company, an experimental line 250 yards long, and the main 15 inches in diameter, and 70 yards in length. The weight of

the carriage propelled was 2½ tons; and it has attained a speed of 30 miles per hour, with a pressure on the piston of ½lb. to the square inch.

The Patentees have introduced several modifications and improvements into their invention since it was first announced: these are the resiliency of the tube, which keeps a longitudinal slip in its upper surface, constantly closed; and, the absence of the ordinary valve, together with all its complication of machinery, sealing, wear and tear, and uncertainty and inefficiency of action.

The present tube is made in sections of iron boiler plate, ¼ of an inch thick, rolled and hammered internally until formed into a perfect cylinder, of sufficient resiliency to close with moderate force. The edges of the longitudinal slit are cut parallel, and made to correspond so truly, that the use of vulcanized India-rubber between has been found unnecessary. The ends of each section are planed, and have rebates cut in them of one inch round, and in which a strip of vulcanized India-rubber is cemented. A girder, or band of iron, is tightly keyed up over the joint, which is thus rendered air-tight and elastic.

On either side, and extending the whole length of the tube, is a horizontal bar, supported by uprights fastened to the sleepers. The horizontal bars are somewhat higher than the tube, to which they are attached in such manner, that when forced outwards, they shall open the tube, and when that force is removed, shall close.

The tube is opened for the passage of the piston by means of four wheels (fixed two and two in an iron frame attached to the coulter), which, being of the necessary diameter, are made to pass in between the two horizontal bars, and, pressing them outwards, to open the tube to the extent of ⅝ of an inch. By this arrangement, the connecting plate passes between the edges of the tube, without touching, and wear and tear, by friction, is entirely prevented.

In order to avoid any strain or friction on the axles of the wheels, they are made of such diameter, that their peripheries shall touch, and the pressure be thus transferred from the axles to the tyres of the wheels.

The piston is fixed like a throttle valve, which admits of its being made to assume a horizontal position, and of the vacuum being thus destroyed at pleasure.—*Mechanics' Magazine*, No. 503.

CUNNINGHAM AND CARTER'S PATENT PNEUMATIC RAILWAY.

This system seems to consist not only of an inversion of the ordinary apparatus of the rail, but of the atmospheric apparatus also, with a mutual adaptation of the one to the other. The prime mover is a vacuum formed by a few moderately sized steam-engines to a whole line, placed any where to suit convenience, and dispersing the vacuum power along the line through an unslit simple copper tube like a gas or water main, to sets of simple air or vacuum engines with which it communicates by valves, which are opened except at stations, or even there, by fitting levers worked by the train itself in passing, so as to open the communication as the first carriage comes up, to continue the working power according to the length of the train, and to shut off the vacuum as the last carriage passes. And the power thus brought into play is carried into action on the train by

means of horizontal wheels planted in sets at every three hundred feet along the line, and griping the train carriages by help of side rails fixed to the carriages; the rails so organized and connected, that the engineer can regulate the adhesion according to the speed required, or at once withdraw it altogether. The copper *main* is laid under ground like any other main. The air or vacuum-engines, which are to be planted outside the line, eighteen pairs per mile, are duplicates, and easily removed, each working its whole set of horizontal wheels, [the revolution of which, by the way, can be readily reversed, although, in fact, we can see no reason why wheels in rotation might not be made to move trains thus in contrary directions on their opposite edges without reversal of their rotation at all.] The whole system, which is held to be far from complex, can be laid down, according to the statement of its friends, on very economical terms—a double line, with the light rails alone requisite, and every other item, costing only £4,000 per mile.—*Builder*, No. 242.

RAILWAY INDICATOR.

Mr. M. Ricardo has described to the Society of Arts, his Indicator for ascertaining the speed of Railway trains. The machine consists of a pair of governors, to which motion is given by means of a band working on a horizontal wheel attached to one of the carriages: as the speed of the train increases, the governors fly open, and pull round a hand which points out, on a graduated dial, the number of miles per hour at which the train is travelling. The governors are prevented from flying open with a jerk by two pieces of vulcanized India-rubber, which lengthen gradually as the speed of the train increases.

REVOLVING RAILROAD GRIPPER.

Messrs. R. F. Stephens, and L. B. Pitcher, of Syracuse, have patented an apparatus for increasing the Traction of Locomotives on railroads. The invention consists principally of two endless chains, which pass over the peripheries of the driving wheels, and a small pair of forward wheels, so that a part of each chain is constantly in contact with the rail. Every alternate link of each chain consists of two short parallel bars, from which projections extend outward; and these projections being at a distance apart, corresponding to the breadth of the rail, gripe the rail when they come in contact, in such a manner as to prevent the sliding of the wheels upon the rail. These projections are called *grippers*, and are connected to each other by pivots consisting of right and left screws; and each pair of screws is connected by a longitudinal strip of iron. When the grippers are passing over one of the small forward wheels, the curved position causes the grippers to expand, but they are drawn towards each other, and caused to grip the rail when the chain is straightened on the rail.—*Patent Journal*, No. 43.

IMPROVED RAILWAY WHISTLE.

Mr. A. Doull, C.E., has patented a new Whistle for Railway and Steam-boat Signals, which is very successful in point of intensity of tone; besides having the advantage of being able to give a variety of

notes, on which a code of audible signals can be made, which it will be next to impossible to misunderstand. It consists of a close vessel or receiver, into which atmospheric air is compressed by air-pumps, to which motion may be given by hand, or by connection being made with any moving parts of the carriage, and disconnected when the air is sufficiently compressed, as shown by a safety-valve attached. The compressed air is allowed to pass through the whistle by the action of a lever, wheel, and axle, or any other known means; and, by having two whistles of widely distinct notes, a large number of different combinations of sounds may be made, from which a most perfect code of signals can be compiled. Air highly compressed gives a far more clear, loud, and distinct tone than steam, or any other elastic vapour.

CHEMICAL RAILWAY ALARUM, OR WHISTLE.

THIS invention, by Mr. Mowbray, chemist, of Paternoster-row, consists of a copper cylinder, with the usual whistle at the top, and a stone funnel within, giving the interior a sectional form, somewhat like the letter V standing within the letter U. At the bottom, or basin of the U, is placed a piece of marble (carbonate of lime), and muriatic acid is then poured into the funnel, or V, which, as it flows on the marble, liberates the carbonic acid gas, or fixed air, which forces back the remaining acid into the funnel, and thereby suspends all further chemical change, even for months, if necessary, till the charge of gas already accumulated is let off to sound the whistle, when immediately the charge of gas is replaced, so that the sound may be repeated even so rapidly as once in every fifth second, if the instrument be set to that precise effect. The sound is said to have been distinctly audible at the distance of half a mile. The weight of the instrument may be reduced to thirty pounds without diminution of power, so that it may be readily lifted off and on the carriages or engines.

ALARUM FOR RAILWAY TRAINS.

A CORRESPONDENT of the *Athenæum* suggests the following means of communication, in case of danger, between the passengers in railway carriages and those who hold the reins of the "iron horse:"—Let the last carriage of every train contain a guard and a Voltaic battery. From this battery let one of the conducting wires proceed directly to the axle of one or both of the pairs of wheels of this carriage, with which contact may be maintained by a spring. Let the other conducting wire pass out at the fore end of the carriage, just under the roof, and there terminate in a spiral link of wire of sufficient length to reach to the next carriage in front. Let the next and each other carriage of the train up to the tender be furnished with a wire running under its roof from end to end—not in contact with any metallic part of the carriage. Let each such wire be continued at one extremity by a spiral link for attachment to the wire of the next carriage, and be fitted at the other end outside with a binning screw, to receive the connector from the carriage behind it. Let each vehicle occupied by human beings be supplied with pairs of forceps—one, at least, for every compartment; and let each of these nippers be inclosed in a case, with a glass front sealed in, in some conspicuous and con-

venient position, so that in case of danger the glass might be broken and the wire cut. Or, instead of these last, let the longitudinal wire be interrupted, in each compartment of the coach, by a simple contact-breaker, in a glazed frame of which the guard shall keep the key; it being his business to ascertain before starting that all the contacts are "turned on." Thus, the danger-signal might be made by a single movement, indicated by a plain direction lettered on each break. This arrangement being repeated in every carriage up to the tender, let the system be continued by an insulated wire running to the fore part of the tender; and here let it enter the alarm apparatus; which should be insulated, and close to, but out of the reach of, the engineer and stoker—the guard having the keys. Let this alarum consist of a small electro-magnetic core and oil; the armature of the magnet being adjusted as the detent of a clock-movement. Let the clockwork be connected with a bell, so that on the release of the detent the spring shall be free to act, and the bell shall commence to ring violently, and continue to do so till the detent be recalled by the magnet. Let then the series of conductors be continued to the electro-magnet; and, having formed its helix, let the wire pass on to the wheel axles of the tender—its extremity being kept in contact therewith by a spring. The expense of this adjustment would be trifling. The trouble which it would entail would only be that of occasionally winding up the alarum spring, of tightening a little binding-screw between each two carriages on making up the train, and of keeping the battery charged: and this last item might be eliminated by substituting for the battery a magneto-electric apparatus, the revolution of whose armature might be made to depend on that of the wheel of the coach. It is clear that so long as contact is maintained the "current" will pass through the series of carriage wires, through the alarum, and back through the rail to the battery; and that whenever the guard either suspends contact at the battery, or a passenger cuts the conductor, or the train breaks, or the last carriage (the most liable to do so) gets off the rail, the "current" will instantly cease, the clockwork will be freed from the magnet, the bell will ring, and the train will soon be stopped. The only errors to which the system would be liable are false alarms:—on the safe side. These might occur by a passenger's wantonness—not likely to be repeated; or by momentary non-conduction between the rails and wheels. In this last case conduction would probably be resumed, and the bell would cease to ring before the engineer could have done more than shut off the steam,—so that no appreciable delay would be caused. Should the last fault be found to occur so frequently as to be inconvenient, the circuit might be maintained by a second set of wires similar to the first, instead of intrusting its completion to the rail. This would add but little complication to the scheme, and would only sacrifice the additional safety in the chance of the last carriage quitting the rail without the instant knowledge of its occupant.

RAILWAY TELEGRAPH AND ALARUM.

Mr. J. D. Hoare, in a paper read to the Society of Arts, proposes, as a means of communicating between the guard and driver of railway car-

riages, that a screw of rods should be passed through the carriages of a train, and united at their extremities by a telescope-joint, so as to allow of extension and contraction. The rods being made with a universal joint, admit of a rotatory motion—the only motion which a railway train has not. At the end of the rod, on the guard's carriage, is a crank, which, when the rod is turned, comes in contact with a hammer, and causes it to strike a bell. A signal is then to be raised, indicating the carriage from which the signal is made. The guard will then immediately ascertain whether it is necessary that the train should be stopped, (?) and if so, by turning the rod in the reverse direction to what the person signalling had done, will ring another bell at the driver's end of the train, or sound the whistle of the engine.

BROOMAN'S PATENT IMPROVEMENTS IN TURN-TABLES.

THERE are four kinds of Turn-Tables at present in use: first, those supported, when at rest or in motion, by rollers at or near their peripheries; second, pillar-tables, in which the weight is supported entirely, or principally, by a central pillar or column, whether the table is at rest or in motion; third, tables in which the platform is supported by rollers, and partly by a column, pillar, or central shaft; fourth, tables which are depressed or raised for the purpose of being turned, and which, when in the act of turning, are supported on a central point or on rollers; and which, when at rest, are sustained at or near their outer edges on fixed bearings, as wedges or cams, but which wedges or cams have to be shifted when the table is to be turned, and again replaced to render the table fit for the passage of a train.

A general defect of these turn-tables is, that, when passed over rapidly by heavy carriages, they are liable to tilt or to deflect, which arises from their not being laid on a sufficiently firm basis, and sustained either continuously or at short intervals under the line of rails. Unless the platform of the turn-table is supported so as to sustain the great weights and sudden shocks of heavy engines and tenders, with their attached carriages passing in succession over it, without any sensible tilting, deflection, or depression in any part, the table becomes dangerous, and the trains cannot pass across it in safety without a slackening of speed or other precautions. Again, from the unequal bearings to which tables supported on rollers and other similar contrivances are subject, the platform is liable to turn slightly as the weight comes suddenly upon it, the effect of which turning is to throw the rails on the platform of the table out of accurate adjustment or line with the rails of the road.

The object of the improvements patented by Mr. Brooman is, to obviate the various defects above stated. Their leading or characteristic feature is this—that the table, when required to be turned, is raised by the pressure of a fluid, and sustained whilst being turned upon the fluid by the pressure of which it was so raised, and when turned to the required position, lowered by withdrawing that pressure; and that the table, when not required to be turned, rests on continuous or solid stationary bearings under the passing weight, instead of on a central column or on rollers.—For details, see the *Mechanics' Magazine*, No. 1266.

UNION OF RAILWAY GAUGES.

Mr. Briant has detailed to the Society of Arts, the following plan for overcoming the difficulties of a break of Gauge, and for Uniting the Broad and Narrow Gauge Railways. At the point of junction of the two gauges, a platform is to be fixed in the centre of the rails; the carriages are then to be placed upon wheels, the two ends of the axles of which are to be made as male screws: on the centre of the axle a pinion wheel is to be fixed, and under it, attached to the frame of the carriage, a lever, upon the upper side of which is a rack, and at the lower end an anti-friction roller. The naves of the wheels are to extend under the carriage in the form of a female screw, to receive the axles. By this arrangement, while the train is travelling on the narrow gauge, the wheels would be screwed up to the required width, the racked lever hanging loosely under the pinion wheel, and the axle would turn with the wheels; but when the train reached the point of junction, the lever would be caught up by the platform (which is to be forty yards long), and with it the rack. The axle would thus be prevented from turning by the pinion wheel and rack; and the wheels, from the weight of carriage passengers, luggage, &c., pressing upon them, would immediately begin to unwind the screw, which, by the time the carriage has reached the other end of the platform, will have extended the axle to the required width: the lever would drop and free the pinion wheel, and the axle would then turn with the wheels as before. The wheels are kept in their position when unwound by coupling rods: in backing the train, the screw is prevented from acting by means of a stop fixed to the carriage, and blocking the axle.

WORKING OF THE "NAMUR" LOCOMOTIVE ENGINE.

Mr. J. R. Crampton has communicated to the Society of Arts, the details of the working of his large wheel narrow gauge engine, the Namur:—for the design for which, he, last session, received the Society's Gold Isis Medal. The Namur is a six-wheeled engine, with the whole of the working parts outside:—

	Feet	In.
The diameter of the driving wheel is	7	0
Ditto supporting ditto	3	9
Distance between the centre of the extreme wheels	13	0
Diameter of cylinder	0	16
Length of stroke	0	20
Number of tubes	182	
Length of do.	11	0
Diameter of do. outside	0	2
Length of fire-box	4	3
Breadth of do.	3	5
Area of fire-grate	14	6
Surface in fire-box	62	0
Surface of tubes inside	927	0
Total surface	989	0

This engine is constructed for the Namur and Liege Railway; and has run on the London and North-Western Railway, with every variety of train, a distance of 2300 miles. The following speeds have been reached:—with a train of trucks, loaded with coke, and weighing eighty

tons, exclusive of engine and tender, fifty-one miles per hour on a level; with a train weighing fifty tons, sixty-two miles per hour. But the most severe test to which an engine can be put is when it has no train behind it. An experiment of this kind has been made, when it was found that with Capt. Coddington, Inspector-General of Railways, Capt. Simmonds, Assistant-Inspector, and the patentee, Mr. Crampton, on the engine, it attained the extraordinary speed of seventy-five miles per hour, on a level, immediately after surmounting a rising gradient; and, at this great rate there was a total absence of all vibration, and a steadiness of movement perfectly surprising. These great advantages are effected in Mr. Crampton's engine by the centre of gravity being brought down to its lowest possible point; the boiler, in fact, being, in this machine, within two feet nine inches of the rails, whilst in engines of the old construction, it ran, at the very least, five inches above their level. The peculiarities of this engine consist in the driving-wheels being placed at the foot-plate end of the boiler; by which means the boiler itself can be brought down close to the supporting axles of the engine—and, from the peculiarity of form before mentioned, any size of driving-wheel may be used without interfering with the position of the boiler, so that longer boilers can be used if necessary. Another advantage secured by this method of building engines is, that no part of the engine overhangs the wheels; inasmuch as the fire-box is extended under the boiler and driving-axle—by which also the distance between the extreme wheels is reduced three feet. The engine in question, the Namur, has only thirteen feet between the wheels, whilst in ordinary engines the same amount of power would require sixteen feet. In addition to these advantages, the driver has the whole of his machinery in view at one time, and in no case is required to get under his boiler for repairs.

LILLIPUTIAN LOCOMOTIVE ENGINE.

This little engine has been constructed by Messrs. Adams, from the drawings of Mr. Samuels, for expresses and surveys on the Eastern Counties Railway. The following are the principal dimensions. The entire length of frame of engine and carriage, which is one, 12 feet 6 inches, on four wheels, 3 feet 8 inches in diameter, the leading and driving wheels being of equal size; and the width from centre to centre nine feet, the wheels being outside all. The frame is divided in the middle by a bulk-head, into two compartments, the foremost containing the engine and machinery, and the latter the seats for the passengers. The boiler is a vertical one, on the American principle, consisting of thirty-four tubes, an inch and a quarter each in diameter, its diameter being two feet, and height three feet six inches. The flue beneath is one foot from the rails, level with the floor, and the entire height of flue, boiler, and chimney, seven feet six inches. The machinery, the working parts of which are all composed of steel, is enclosed in boxes on the sides of the compartment, consisting of two inside cylinders, three inches in diameter, with a six inch stroke, crank axle, link motion, with the usual reversing gear. The water tank is in the cross seat, against the division board of the two compartments, and will hold a sufficient supply for a run of from

eighteen to twenty miles. Coal is used, in consequence of its being so much easier of combustion than coke, in a furnace of such small dimensions. The passenger compartment is open, and resembles what is termed an inside Irish car, having a seat crosswise against the division board, and one on either side, which together will conveniently accommodate seven persons. The weight of the whole, which is suspended on spiral bearing springs, when in working order, exclusive of passengers, is about 22 cwt., and is able to travel at the rate of forty miles an hour, the boiler having borne with ease a pressure of 200 to the square inch; but it is not intended to drive her at this rate of speed or pressure on ordinary occasions.

In a trial trip, Mr. Samuel, with this little engine, accomplished the journey from London to Cambridge (57½ miles) in one hour and three quarters; in more than one instance during which, the speed attained was at the rate of forty-three miles per hour.—*Illustrated London News*, No. 287.

SECOND RAILWAY TUNNEL BRIDGE.*

The site of this Bridge is on the south side of Telford's "Suspension-Bridge," close to the wall of the Conway Castle Bridge, (also by Telford). It will be precisely of the same description as the one to be thrown across the Menai Straits, the Conway Bridge consisting of two tubes or tunnels (one for the up and the other for the down line of rail), each 400 feet in length. It is rectangular in form, consisting entirely of sheet iron, one inch in thickness. The inside, through which the trains are to pass, is twenty-four feet high and fifteen feet wide. The outside height is much greater, being about thirty feet. The top is of two thicknesses of corrugated metal, forming a series of circular tubes of about three feet in diameter. This form is considered to offer the greatest resistance to compression. The sides are of sheet iron of one thickness; the bottom has a double thickness, three feet apart, connected by intermediate longitudinal ribs, so as to give the necessary stiffness for the carriages to pass over. The whole mass, weighing upwards of 1000 tons, will be placed on the abutments at once. The place where it is being constructed is on a huge timber platform, in a curve of the Conway, a few hundred yards from the intended site of the bridge. Immediately the tube is completed, with the aid of a flood tide and pontoons it will be raised so as to admit of the platform on which it is erected being carried away.—*Shrewsbury Chronicle.*

REMINGTON'S AERIAL BRIDGE.

Mr. Remington, a native of Alabama, U.S., has had constructed at the Surrey Zoological Gardens, an "Aerial Bridge," similar to one erected from his design, and already in practical operation at Washington.

On either side of the sheet of water at the Gardens, a stout buttress of timber, about eight feet in height, is erected; and on these buttresses, stretching across the water-way, a distance of twenty-four feet, are laid four laths or stringers, of common deal, tapering from about double that

* The first, or "Britannia Bridge," will be found at page 55 of the present volume.

thickness to *one inch square*, in the centre of the water-way, where the greatest strain and pressure might reasonably be expected. This constitutes the bridge previously to the footway being laid on. The foot-tread is formed of slips of deal, glued across the longitudinal stringers; there is no central support, or intervening braces, either from above or below; and yet over this slight and aërial structure, thirteen or fourteen stout men march at once, without fear or hesitation. Mr. Remington assures us that three or four times this number of persons may cross it at once with the most perfect safety, and that there is no practical limit to the length of the bridge. The "magic" of the structure and the novelty of the principle consist in the application of the longitudinal fibre of the wood, so that every portion is brought at once into play, and supports an equal share of the strain. The rapidity with which such a bridge can be constructed, and the comparative insignificance of the cost, are among the obvious advantages of the invention.

BROCKEDON AND HANCOCK'S PATENTED IMPROVEMENTS IN INDIA RUBBER AND GUTTA PERCHA MANUFACTURES.

THE patentees state their invention to consist of a peculiar means of applying Caoutchouc and Gutta Percha to a variety of purposes to which they have not heretofore been applied; and that although they have adopted the terms India rubber and gutta percha because most convenient, they desire to be understood as including all those varieties of hydro-carbons known to botanists as of vegetable origin, and which varieties take their names from the countries whence they are exported—as Saikwah, West Indian, Madagascar, Java, &c.; or from names given by the natives, such as jintawan, gutta tuban, gutta percha, dolla, &c., or from the state in which it is imported, such as liquid, bottle, root, scrap, &c., all of which details have been described by Dr. Roxburgh, Lieut. Veitch, and others, in the Proceedings of the Agricultural and Horticultural Society of India.

When India-rubber (the vegetable substance known by that name,) or any of its varieties, all of which differ from gum, sugar, starch, &c. in not being soluble in water, however compounded, are employed for the purposes of manufacture, they are subjected to the same, or very similar processes, viz., rolling, masticating, &c. From all these varieties, caoutchouc is obtained by destructive distillation, and all effected by the same solvents.

When gutta percha is to be used, the spreader and bed of the spreading machine have to be kept at a temperature of from 190 to 200 degrees Fah. —a great disadvantage attending which is stated to be that, although it is considerably harder than India-rubber, yet, in comparison with the latter, it is effected at a comparatively low temperature.

The present patentees render leather, cloth, and other fabrics, partially or entirely waterproof, by coating them with caoutchouc or gutta percha, or a compound of both, in solution or otherwise, and then immersing them in a bath of a solution of chloride of sulphur and bisulphuret of carbon. When the fabric is coated on one side only, the selvage edges are to be joined as well as the ends, and, in this bag-like form, immersed. In order to stop out the injurious effect of the solution on the fabric, that part which it is desirable to protect should be coated with glue or size, or with an aqueous

solution of shellac. The former may be removed by the application of hot water, and the latter by that of any suitable alkaline solution, when the process is completed.

The surfaces of the fabrics may be embossed, printed, and ornamented, prior to or after the " change."

The patentees give a long list of articles of all kinds, and for all purposes, to which their invention may be applied; and conclude with stating, that whereas Mr. Parkes proposed to immerse caoutchouc and gutta percha, or a compound of both, in a raw state, their invention consists in immersing them in a manufactured state. And, farther, in subjecting the different articles, manufactured from caoutchouc, under the various patents of Mr. Hancock, such as thread, sheets, &c., to " change."*

THOMPSON'S PATENT ÆRIAL WHEELS.

The reader will, perhaps, recollect that the peculiarity of these Wheels consists in their tires being formed of tubular rings made of India-rubber vulcanized, and inflated with air to any degree of lightness desired. (See *Year-book of Facts*, 1847.)

By recent experiments with these Wheels, it has been proved that after travelling 1200 miles on all sorts of roads, the wheel-tires have not been deteriorated. It also stands established, that we have here a wheel which not only makes little noise, or, more strictly speaking, perhaps, which is in itself noiseless,—for to us it seemed, as if all the noise were occasioned by the rumbling of the body of the carriage, and parts in connection with it—but which requires from one to three less tractive power than a common carriage; and which must consequently be much less subject to wear, and last proportionately longer.—For the details of the experiments, see *Mechanics' Magazine*, No. 1233.

CEROGRAPHY.

By this system, the invention of Dr. Morse, a map may be drawn as quickly and well as with a pen and ink on paper, in a ground as thin and perfect as a common copper-plate etching-ground; and in a few hours, perhaps a few minutes, may be obtained from it a type-metal plate, which shall print every point, line, and letter of the drawing under the common printing-press, as rapidly as newspapers are printed. For clearness and beauty, these maps far exceed any wood engraving. In particular, the writing on the lines representing water, and which can hardly be done at all in wood, is effected by Dr. Morse's process in a manner little inferior to copper-plate. The discovery has already been most extensively applied in America.—*Proceedings of the Geographical Society.*

WARMING AND VENTILATING THE NEW HOUSE OF LORDS.

Prof. Faraday has read to the Royal Institution, a paper, " On Mr. Barry's mode of Warming and Ventilating the new House of Lords." Mr. Faraday commenced by disavowing any desire whatever of instituting comparison between the plan adopted by Mr. Barry for supplying the

* See Gutta Percha and its applications, at page 232 of the present volume.

House of Peers with pure air of required temperature, and any other schemes of ventilation which, either at the present or in former times, had been made subjects of public discussion. Having been officially called upon in respect of Mr. Barry's arrangements, Mr. Faraday considered it his duty to acquaint himself thoroughly with them: and the result of his investigation induced him to bring these arrangements before the Institution, as beautiful applications of a philosophical principle. Mr. Barry's plan of warming and ventilating the three rooms (*i. e.* the royal ante-chamber, the House of Peers, and the public lobby,) consists, first, in causing a current of air, of regulated temperature, to pass beneath the impervious floor of these apartments, and afterwards to rise to a chamber at the top of the building,—from whence it is diffused in great abundance, but imperceptibly, throughout the three apartments; and, secondly, in drawing off the vitiated air and discharging it with great rapidity into the atmosphere.

To accomplish these objects, Mr. Barry has achieved expedients for,—1. Warming the building through an impervious floor, as in the case of a Roman bath. 2. Effecting a system of currents. 3. Providing means of causing ten thousand cubic feet of air per minute to proceed on a prescribed course and with regulated velocity. 1. Mode of Warming.—A steam-cockle, supplied from one of Lord Dundonald's boilers, is traversed by a quantity of air-tubes firmly fastened into it. The air which passes through these tubes is the source of warmth. This apparatus, with its furnace, is placed beneath the public lobby; and the current of warm air passes beneath its impervious floor, then beneath that of the House of Peers, and lastly beneath the floor of the royal antechamber beyond. With warmth, the air acquires a certain degree of motive power in the rising parts of the passages, which carries it onward till it reaches the reservoir chambers at the summit of the building: from thence it is made to pass down into the apartments by their walls, and so distributed, without draught, to be breathed by the inmates of those rooms. This gradual diffusion of the air is accomplished by—2. A system of currents. These currents are caused by subjecting the air to inequalities of temperature. Descending by the walls of the building, it is cooled by windows, &c.; and thus its velocity downward is increased. Arriving at the level at which it is at once heated and deteriorated by respiration, combustion, &c., the air again rises in the centre of the room, and passes through the ceiling into a foul air chamber which is in connexion with a chimney. Through this chimney, the air is driven by the third expedient adopted by Mr. Barry, viz., draught of the flue, a peculiar motive power, furnished by Bell's steam-jet. In the course of his communication, Mr. Faraday described the arrangements made by Mr. Barry to clear the air, and to regulate its velocity so as to prevent the possibility of draughts coming on any inmates of the apartments. He showed how the steam-cockle, employed to give warmth in winter, might, by filling it with water from the artesian well, become a source of coolness in summer. These and many other important arrangements were illustrated by sections in relief.

Prof. Faraday concluded by stating the following summary of the

advantages expected from the mode of ventilation which he had described. 1. The prevention of local draughts. 2. The prevention of the stains and disfigurements resulting from such draughts. 3. The avoidance of all movement and dispersion of dirt and dust of the house by currents occasioned in it;—which currents, if existing, would tend to render the air impure. 4. The avoidance of all sudden changes of temperature. Finally, it was noticed that all parts of the house were fire-proof. Mr. Faraday then took occasion to remark that this scheme of ventilation was under a disadvantage in the present case, as it had to be adapted to buildings which were not planned with reference to it.—*Athenæum*, No. 1014.

In a subsequent communication to the Royal Institution, Mr. Faraday considered the physical conditions of the steam-jet, and the relations of the vapour discharged from it to the surrounding air. More than forty years ago, Dr. Young, (*Nat. Phil.*, vol. ii. p. 534) had shown that wherever any elastic fluid was forced from a jet with but small velocity, the steam proceeded for some inches without observable dilatation, and then diverged into a cone; but that when the pressure on this vapour was increased, the apex of the cone approached the orifice of the jet; yet, whatever might be the amount of this pressure, the form of the cone continued the same. Mr. Faraday proceeded to notice the lines of motion of the particles constituting this cone of vapour. The rings of smoke produced by the combustion of bubbles of phosphuretted hydrogen on the surface of water were exhibited. The revolution of each of these hollow rings on the axis of the cylinder which forms it was pointed out, as was their gradual expansion when rising into the air: and it was shown that each of these enlarging rings might be viewed as a magnified element of the cone of steam issuing from the jet. In the same class of effects, Mr. Faraday placed the rotating clouds of smoke which are seen issuing from the chimneys of steam-boats, &c. The force with which the particles of the air surrounding the cone of steam produced by a powerful jet were drawn towards it, were shown by various striking experiments. Hollow balls of one and two inches diameter were seen drawn into the cone, and sustained floating in the line of its axis, even when, by an arrangement of the apparatus, this axis was brought 55° out of the perpendicular. An upright glass tube, eighteen inches long and one inch in diameter, having one extremity plunged into water and the other end drawn into a capillary jet, was visibly exhausted of its contained air (the water being drawn up from the lower end of the tube) when the capillary jet was placed within the in-draught of air occasioned by the cone of steam.

In closing this part of his subject, Mr. Faraday explained the use which had been made of a cylindrical or conical jacket to include this steam-cone, and thus to increase the draught power of the jet. In the arrangement adoped by Mr. Barry for ventilating the House of Lords, this jacket is the ventilating-shaft itself; so that there can be no room for the entrance of air to form a downward current in the shaft. This mode of moving air has been adopted in lead-works and other manufactories, for the purpose of washing and condensing the smoke where noxious fumes are generated in the processes. Noticing the coolness of the high-pressure steam, even near the orifice of the jet, as being due to the

quantity of cold air rushing towards it and diminishing its temperature, Mr. Faraday connected with this and the other phenomena the experiment of M. Clement Désormes, who showed that, when steam, under high pressure, is allowed to escape from an orifice pierced in a plate, and a flat disc is brought close to this plate, the plate and disc are made to adhere together. In this case, the elastic force of the steam issuing from the jet, and which tends to separate the plate and disc, diminishes rapidly in its course from the centre to the edges of the disc; at the same time, the radial currents, by their in-draught, as before illustrated, bring the two plates together with a power which is so much greater than the former that the surfaces adhere. Mr. Faraday finished by noticing the danger of conical safety-valves in high-pressure boilers, when the lateral expansion of the conical surface is large in proportion to the sectional area of the steam passage.—*Athenæum*, No. 1025.

We perceive that Dr. Reid, taking the above as the basis of his remarks, in a lecture delivered at Willis's Rooms, on May 15, has entered *seriatim* into a consideration of the statements in the Report upon the subject—illustrating by models and diagrams the various points to which he directed attention. He denied altogether that there was any peculiarity in the principles introduced in the New House of Peers, that had not engaged his (Dr. Reid's) attention, and which was not illustrated or practised, either in models or on special occasions, in the Painted Chamber when occupied as the House of Peers. He would fully accord to Mr. Barry the credit of such combinations as should be manifested in his works, when he (Dr. Reid) should have the opportunity of examining them. In the meantime, therefore, he confined himself to the *Athenæum*, and considered that he had afforded evidence that, if plans had not been suggested to Mr. Barry such as he had adopted in the House of Peers, it was not because they were unknown or neglected, but because it was felt and asserted that better plans could be introduced. Dr. Reid concluded his lecture, by detailing what he designated certain systematic misrepresentations to which he considered he had been subjected by some portions of the newspaper press; adverting also to the retention by Mr. Hardwicke, Mr. Stephenson, and Professor Graham, of a document, by which he was deprived of an important portion of the evidence that contradicted the assertions made before a committee of the House of Peers—on the consideration of whose Report an address to the Crown was carried depriving him of the ventilation of the new building.—*Athenæum*, No. 1021.

"THE AMPHION" SCREW STEAMER.

This new Government steam-ship is fitted with engines on Count Rosen's principles, different from any used in the Royal Navy. They are similar to locomotive engines, and act horizontally, with a four feet stroke, directly attached to the axle of the screw propeller with which the steamer is filled: she also dispenses with the cog wheels, required for the *Rattler*, the *Fairy*, the *Dwarf*, and other screw-propeller vessels. The engines of the *Amphion* are only 150-horses power each, and were found on her trial trip sufficient to give the vessel a speed of $6\frac{3}{4}$ knots in an hour and a half against wind and tide. When her full speed is attained, she will average

about six knots per hour. The engines worked remarkably easy, making from 36 to 44 revolutions per minute. The vessel during the trip was immersed 17 feet 11 inches in the fore part, and 18 feet 4 inches aft. Her armament consists, on the upper deck, of two 56-pounders, eight 32-pounders, and two land service guns, (on traversing platforms,) and on the lower deck, four 8-inch guns, and sixteen long 32-pounder guns, with a large quantity of shot and shells.

LAMB AND WHITE'S PATENT LIFE-BOAT.

This Boat has been invented and patented by Mr. A. Lamb, of Southampton, and Mr. John White, of Cowes. The primary and indispensable characteristics of a life-boat are buoyancy and stability; with which should be conjoined strength and tolerable sailing qualities. In all life-boats, buoyancy is obtained by the employment of air-vessels, or substances, such as cork, which are of less specific gravity than water. In the best boats hitherto made, however, the buoyancy is subversive of stability, from the injudicious position of the centre of buoyancy, which being beneath the centre of gravity of the boat, gives it a dangerous tendency to tilt over, bottom upwards, especially when the boat is filled with men; whereby the centre of gravity is elevated still further. Besides, the air-vessels, however strongly attached to the boat, do not contribute to the strength of the boat, while they add to its weight and unwieldiness. In Messrs. Lamb and White's new life-boat, the arrangements adopted to insure buoyancy are, at the same time, conducive to the stability and strength of the boat; so that with the same weight of materials as one of the ordinary life-boats, a superior degree of safety and efficiency, with increased accommodation, are at once attained. The air-vessels in the new life-boat form a trunk round the inside of the boat, rising as high as the gunwale, but only extending down on each side as far as the bilge, whereby the centre of buoyancy is kept so high, that it is impossible to capsize or swamp the boat. The upper part of the air-trunk is rounded off inside, to permit the boat to be partially emptied of water as she rolls, and to facilitate the use of the oars; and the trunk is divided by partitions into several water-tight compartments, so that no material injury could accrue from one of them being accidentally stove. At either end of the boat, which may be used indifferently as stem or stern, a water-tight compartment is partitioned off, in which provisions, compasses, signal-lights, and other necessaries, may be constantly kept, to obviate the risk of their omission or neglect in the confusion arising from any sudden emergency.

One of these new life-boats has been tested at Southampton, before several officers of Her Majesty's Navy, and of the East India Company's Service, and gave most satisfactory results. Its dimensions are 30 feet long, 9 feet broad, and 3 feet deep; it is built of mahogany, and weighs between 17 and 18 cwt., which does not exceed the weight of an ordinary ship's boat of similar dimensions. It was found to possess good sailing qualities, being remarkably stiff under canvas, quick in stays, and easily worked. With 134 men on board, the gunwale was 13 to 14 inches above water; when filled with water, it carried 23 men

without any increase of immersion, and was found to possess greater stiffness than when altogether empty. To test its stability, 40 men standing on the gunwale endeavoured to capsize it, when filled with water, but only succeeded in immersing the gunwale six inches under the water; and from the rounded form of the gunwale inside, the rocking motion communicated to the boat cleared it of water at every roll. From the various trials that have been made, it has been proved that a life-boat of this description, equipped for any emergency, could yet be used for the ordinary purposes of a ship's boat, without requiring alteration; it could be launched when under weigh, or in a heavy sea, even with men on board, without the risk of swamping or capsizing—which indeed, under the most adverse circumstances, would be all but impossible.—*Abridged from the Artizan.*

RAISING OF THE GREAT BRITAIN STEAM-SHIP.

THE raising of the *Great Britain* steam-ship from her perilous position in Dundrum Bay, has involved a series of operations which are worthy of place in our record of the mechanical labours of the year. The first trial to raise the ship was made under the superintendence of Captain Claxton, whose beneficial watching during the winter, it will be remembered, was of such great service. Having boiler-builders on board, Captain Claxton ordered the upper cargo deck to be tightened, and shored or supported from the deck above, as well as all the coal bunkers tightened. As soon as these preparations were completed, and when the weather and tides became favourable, the ship rose four feet, and was maintained at that height by pulling her to one side, and filling in stones at the other side. Additional attempts of the same kind were made; but the ship being raised to the height described, lost her former buoyancy, and, consequently, could not raise higher.

Mr. James Bremmer, C.E., with his son Alexander Bremmer, C.E., were then sent for, and they devised and recommended the following scheme:—

First, Twenty large boxes were made, to contain upwards of thirty tons of sand each. Ten boxes were suspended on each side by strong chains, which went over pullies in the upper part of large vertical baulks of timber, the same chain passing through pullies attached to the side of the ship, thus doubling the weight of sand in the boxes, less the friction; and, it should be added, those boxes in the middle of the ship, opposite the engines, had four powers to each, to prevent straining the ship at that part.

Very powerful levers were put to the fore-end, capable of lifting about 190 tons; and, along the sides opposite the large timbers, formerly on the ship, were also placed levers, capable of lifting about 200 tons each. In addition to this lifting power of boxes and levers, was applied screw-power, capable of lifting 160 tons. These screws were placed near the hawse-holes, on a stout frame of timber, which was on immense end-wood supports.

The levers on the sea side of the ship were ballasts with chains, anchors, and parts of the engine; as also were those on the fore-part. The

sea had, therefore, little surface to strike against; while the levers on the land side of the ship were ballasted by a large iron boat filled with sand.

When the lifting power was about complete, on the 13th of July (spring tide), it was thought advisable, as the good season was passing, to make the first attempt; and, then, to the surprise of all on board, the ship lifted so rapidly, that the valves had to be opened to prevent her going up further.

This first trial, it appears, was set about too prematurely; as sufficient preparations had not been made to retain the ship at the required height; consequently, on the receding of the tide, several of the boxes and baulks were injured.

To provide for maintaining the ship at the required height, some thousands of small piles were driven, reaching from the surface of the sand to that of the rock; and on those piles were laid foundations for vertical supports, which, by an ingenious contrivance, were made self-acting, so that as the ship rose the shores placed themselves.

In addition to these shores, were many immense wedges, hauled in at the fore-keel and bilges; stones were also put under her with long shutes from the deck.

The gratifying result of all these preparations was, that, on Thursday, the 29th July, the ship was raised to the required height, so that the boiler-builders could get at the bottom to make it water-tight.

All these appliances, however, were cleared away previous to the tide of Wednesday night (25th August), preparatory to the final attempt to remove the vessel from the shore.

On the flowing of the tide on Wednesday night, floating operations were commenced, by means of anchors laid out astern, and the warps attached to which were hove upon by the vessel's windlass and capstans. These were so far successful as to move the ship about three fathoms farther to seaward, in which position she was permitted to remain until the following day. The *Birkenhead*, iron steam-frigate, of 1,400 tons, and 600 horse power, had come down from Kingstown early in the week to act as a tug when required; and the *Scourge*, steam-bomb ship, of 400 horse-power, had also been despatched to the Bay of Dundrum, and anchored about a mile and a half to the south-eastward of her stranded sister. A large number of the crews of these two steamers were aboard the *Great Britain*, and very efficiently contributed to the success of the experiment. Mr. Bellamy, Second Master-Superintendent of Portsmouth Dockyard, and a strong detachment of riggers from the dockyards both of Portsmouth and Plymouth, were also on board the *Great Britain*, and rendered good service.

On Thursday, recourse was had to the steam power of the *Birkenhead*, but, owing to the failure of the floating apparatus in two large lighters alongside the *Great Britain*, and to the lowness of the tide, which, owing to a northerly wind, which had prevailed for some days, did not rise so high as had been expected; all the efforts made to remove the vessel were entirely unsuccessful, she not having been towed out even one foot.

On Friday, at the flowing of the tide, about twenty minutes before noon, the final experiment to float off the ship was attended with the

most complete success. Two 'best bowers' had been laid out a cable's length astern, and, in addition to these, two strong warps had been spliced to those of the *Birkenhead*. By heaving on these, the mammoth steamer was towed out to seaward upwards of eighty fathoms, and into snug moorings: in the afternoon, she reached Belfast, and Liverpool on Monday.

A very interesting series of illustrations of Captain Claxton's and the Messrs. Bremner's operations sketched in Dundrum Bay, will be found in the *Illustrated London News*, No. 277.

CAST-IRON LIGHTHOUSES.—NEW LIGHT.

Mr. Alexander Gordon, C.E., has published a letter on "the Lighthouses of the British Colonies and Possessions Abroad," in which he refers to several improvements, as regard expedition and economy, which he has introduced; and presses the necessity for establishing a Lighthouse Board, to which, at least, twenty great lights ought, at once, to be handed over. Mr. Gordon also asserts, that all our colonial lighthouses and harbour lights, upwards of 140 in number, with few exceptions, are radically ill managed, and most of them essentially bad in construction, action, and mutual relation.

Mr. Gordon states, that the three great lighthouses at Point Morant, Jamaica; Gibb's Hill, Bermuda; and Point De Galle, Ceylon; have been executed by him with a rapidity greater than had previously been thought possible. They are lights of the first order and power, and in no way inferior to the best lighthouses at home, which have cost much more money; and on these three lights have been saved nearly £50,000 of the public money.

The Skerryvore Lighthouse, recently completed in Scotland by Mr. Alan Stevenson, cost nearly £100,000: Mr. Gordon would build in Simon's Bay, Cape of Good Hope, a lighthouse in as difficult a position for one-tenth part of the money.

"It will be seen," says Mr. Gordon, "that iron lighthouses, constructed of *cast* iron, or of *wrought* iron, or partly of *gun-metal*, according as circumstances may demand, are cheap, easily erected, strong to resist vibration in hurricanes, cannot be injured by lightning, and are safe in case of earthquakes and fire. The lining of these towers, and the arrangement for ventilation, provide the desired and uniform temperature. These advantages, and the advantages of wrought-iron towers, or funnels in floating lights, by which the light attendants can ascend to the light in all weathers, are all carefully stated in my evidence before the Select Committee of the House of Commons on Lighthouses, 1845."

Mr. Gordon has exhibited to the Trinity Board a new system of lights proposed by him, and which is a following out of his prolate reflectors, as applied to the Ceylon lighthouse, by saving the radiated light which formerly escaped past the lips of the reflector. This latter portion of the light, which was formerly lost, is now bent down and thrown into the beam. In a specimen light, only about an inch in diameter, from a common Argand lamp, its dazzling brilliancy was scarcely subdued at a distance of fifty yards. Mr. Gordon says, he combines a very prolate

reflector and the refractor of Sir D. Brewster deprived of its central portion; and, by this system, he adds, "I am enabled to throw into a beam nearly twenty-seven 28ths of the whole light generated by an Argand lamp." The parabolic reflector fixed horizontally, opened at 13½ inches from the light, (which was inserted through the focal portion), at a diameter of 15½ inches: and at 14 inches from the mouth of the reflector were fixed glass zones, used as the refractors, being composed of four circles, varying in size and thickness, the inside of an even face, but on the outside the glass was cut away into curved steps, so as to prevent useless portions absorbing any of the light.

Mr. Gordon proposes, for revolving lights, to use one or more of these systems, each furnished with an Argand burner, on one or more revolving faces, according to the size of the required beam. For fixed lights,—to use such a number of these systems as will light the circle (of 360°), or any required portions of the circle; twenty-four systems, each with its own lamp, for the whole circle; twelve systems for the half-circle, and so on; one system for 15°. For floating or intermittent lights,—such combination of these systems as the situation may require; the source of light being superior to any known, and convenient for the purpose.*

NEW CONDENSING ROTARY STEAM-ENGINE.

Messrs. Cordes and Locke, the inventors of this new engine, have described it to the Society of Arts. It belongs to the numerous class of rotary steam-engines, but differs from them in two respects:—1st, That whereas they have extensive rubbing surfaces which require great accuracy and careful packing, and are attended with much friction and loss of power, this has no packing and scarcely any friction, being merely a wheel or vanes revolving within a case, and receives impact from the steam as it passes from the cylinder to the condenser. 2nd, That whereas the common engine revolving at high velocities has to encounter great resistance from the air, this wheel revolves in vacuum, by means of a condenser worked by a triple pump separated from the machinery of the engine. The proof which the patentee offers of the excellency of the engine consists in the results of certain experiments made on a large scale in pumping water, and in direct competition with engines of the common form; in which he stated it was made to appear that the same general useful effect was obtained from the new as from the old engine, but with a much simpler and cheaper apparatus. The paper concluded with the account of a large experiment in which the rotary engine was used as an auxiliary to a common engine, with a gain of one-third more power. Mr. Cordes gave an account of the working of the experiments that had been made; after which a discussion took place. The cost of constructing an engine on Messrs. Cordes and Locke's principle is stated to be from £15 to £20 per dynamometric horse-power, exclusive of boilers; the weight of engine per horse-power not exceeding 4 cwt.

* See the first application of Gas in the Hartlepool Lighthouse, described at page 70 of the present volume.

DR. WALLER'S PATENT COFFEE-POT.

THIS apparatus consists of a vessel divided into two equal parts by a solid partition, shaped like a dinner-plate, and having the central depressed portion pierced by a hole, around the edge of which is attached a bent tube connected with a tap; so that, by this arrangement, a passage or way may be opened or shut at pleasure from the upper to the lower half of the vessel, the trough or strainer, which consists simply of a piece of very finely perforated metal, soldered around the dished part of the partition. Ascending from within a short space of the bottom of the lower chamber to within nearly the top of the upper one, is a tube passing through the partition and perforated plate, to both of which it is firmly soldered, and which tube is surmounted with a valve. There is an ordinary spout having a cork or plug fitting air-tight.

To use the coffee-pot, remove the cork from the spout, pour the water into the upper chamber, turn the tap downwards so as to allow the water to run into the lower half; this done, put in the ground coffee, turn the tap again horizontally, replace the cork or stopper, and set the vessel on the fire. When the rattling of the valve, and escape of steam from under the lid, have continued a few seconds, take the coffee-pot quite away from the fire, allow it to stand two or three minutes; then turn the tap downwards, and the infusion will rapidly filter into the lower division, and be ready for use. The water may be used hot or cold; if hot, a gallon of coffee may be made in three or four minutes.

The principle of this apparatus is—that, when it is placed on the fire, the water in the lower division is found, by the pressure of steam and air up the central tube, lifting the valve, and made to fall in an uniform stream, *at a gradually increasing temperature*, *upon* the coffee: as soon as all the water above the inferior orifice of the central tube has been forced up, then only steam arises; when the vessel is removed from the fire, the valve falls, and prevents the re-entrance of air into the lower chamber after its total expulsion thence by steam; during the infusion, the steam in the lower chamber is allowed to condense; and thus a vacuum is produced, and preserved for any period, and rendered available for effecting rapid filtration wherever derived, by employment of the tap. One of the great advantages is, that the steam making its exit *over* the infusion, and not *through* it, serves as a medium of protection; and thus, none of the fragrant properties of the coffee, which are of a most volatile nature, can be lost. The apparatus may also be used for infusions, mixtures, tinctures, jellies, &c. and the fineness increased by a layer of flannel over the strainer.

FALL OF A RAILWAY BRIDGE.

THE Chester and Holyhead Railway is carried over the Dee by an iron girder bridge of three bays or spans of 98 feet each. While a railway train was passing over it, on May 24, one of the girders of the bridge gave way, and the greater part of the train was precipitated into the river: five persons were killed, and several injured.

A great difference of opinion prevailed respecting the cause of this accident. The inquest jury (Sir E. Walker, chairman) returned a verdict of "Accidental Death," accompanied with the following observations:—

"We are further unanimously of opinion, that the aforesaid girder did

not break from any lateral blow of the engine, tender, carriage, or van, or from any fault or defect in the masonry of the piers or abutments; but from its being made of a strength insufficient to bear the pressure of quick trains passing over it.

"We feel that the eleven remaining girders, having been cast from the same pattern, and of the same strength, are equally weak, and consequently equally dangerous for quick or passenger trains as was the broken one.

"We consider we should not be doing our duty towards the public if we separated without expressing our unanimous opinion, that no girder bridge of so brittle and treacherous a metal as cast-iron alone, even though trussed with wrought-iron rods, is safe for quick or passenger trains; and we have it in evidence before us, that there are upwards of one hundred bridges, similar in principle and form to the late one over the river Dee, either in use or in the course of being constructed, on various lines of railways. We consider all these unsafe, more or less, in proportion to the span; still all unsafe.

"We therefore call upon Her Majesty's government to institute such an inquiry into the merits or demerits of these bridges, as shall either condemn the principle or establish their safety to such a degree, that passengers may rest fully satisfied there is no danger, although such bridges may deflect from 1½ to 5 inches."

CANTELO'S PATENT HYDRO-INCUBATOR, FOR HATCHING CHICKENS.

This Machine is very simple: it consists of a cistern of water hot, which is heated by a peculiar stove, the heat of which is shown by a thermometer. This water is heated to 109°, and flows over a surface of vulcanised caoutchouc, the lower surface of which is in contact with a tray or nest of eggs, and maintains a heat of 106°. The tray is open at the sides, the bottom is made of wire gauze, lined with cotton canvas, and is raised or lowered by wedges, thus merely presenting a small surface to the lower surface of the caoutchouc, which represents the breast of the parent fowl, and thus only a *top contact heat* is communicated to the egg. Around the stove is a warm chamber, in which the chickens are put as soon as hatched, and where they remain about thirty-six hours before taking food; they are then placed under the Hydro-Mothers, which consist of a series of pipes, kept at a same heat of 106°, and under which the chickens nestle as under a real mother.

There is now no further trouble. During the first ten days, the chickens feed themselves in the house, and are then only permitted to go out in the open air, returning at pleasure to the protection of the Hydro-Mother. At the end of six weeks they are put into a common roosting-house, and henceforth shift for themselves.

In a large Hydro-Mother, 44 feet long, the warm-water pipes are placed about four inches from the ground, and a moveable board is so placed that the backs of the youngest chicks just touch the pipes, the board being lowered as the chickens increase in size.

The Hydro-Incubator has been exhibited at No. 209, Regent-street; as also at Mr. Cantelo's Model Farm, at Chiswick, where he has more than 2000 head of poultry running about, from one day to three months old. —*Illustrated London News*, No. 297.

WALKER'S PATENT HYDRAULIC ENGINE.

Mr. John Walker has patented the invention of a Hydraulic Engine, which accomplishes for short lifts what the Cornish engine does for deep ones. This Engine consists of a strong cast-iron framing, about 4 feet square, within which all the machinery is contained. On a table at the upper part, there are two steam-cylinders, each 11 inches in diameter; and immediately beneath them are two water-cylinders, each 24 inches in diameter.

From cross-heads above the steam-cylinders, and attached to the steam-pistons, connecting rods pass down, and are bolted to platforms which carry the water-pistons. The water-cylinders are open at the bottom, and are immersed in a cast-iron well, fitted with sluices, to admit water from the drains or from the river, so as to be equally applicable for draining or irrigating. The water-cylinders terminate at the upper part in a capacious valve-box, communicating with the delivery-main, which is also furnished with sluice-doors for discharging the water inland or outwards. The valves in the water-cylinders and pistons are of a novel and excellent construction; consisting of a large number of rolled iron tubes, which lie in circular seatings across the piston, rising and falling in guides which limit their motion. By this arrangement, a very free passage is afforded to the water, and the valve acts without the slightest shock, even when the Engine is working at a high velocity.

The steam-cylinders are single acting, steam being admitted alternately between them, by a slide valve worked by an eccentric in the crank shaft, which connects the two steam pistons and carries a fly-wheel to regulate the action of the Engine. Two of these machines, constructed for draining estates in the West Indies, have been tested at Mr. Walker's premises: with steam of 35 lbs. upon the inch, and making 70 revolutions per minute, the piston stroke being 2 feet, they lifted 6,000 gallons of water 8 feet high per minute.

As these Engines *throw up* the water—not lift it—the ordinary mode of computing the performance of the Engine (its capacity multiplied by its velocity) is inapplicable. At the speed stated, that mode of calculating gave less than half the quantity actually raised; and, at an increased speed, the disproportion would be even still greater. The superiority of Mr. Walker's Engine over the ordinary pump has been most satisfactorily established in the presence of Sir Francis Collier and Capt. Dennison, at Woolwich Dockyard, where the large caissoon was formerly emptied by a pair of very excellent 10-inch pumps, fitted up in the best manner by Sir John Rennie's firm. With these pumps it took thirty men (working in gangs of fifteen, and relieving every 15 minutes) three hours and a half to empty the caissoon. With one of Mr. Walker's engines, fourteen men (working in gangs of seven, and relieving every 15 minutes) emptied the caissoon in one hour and a quarter; and have, on recent occasions, done it in less, without being fatigued. Mr. Walker has supplied one of his Engines for the Dockyard at Malta, and has completed another for Portsmouth. The Board of Admiralty is about to adopt this important invention in ships of the largest class, which may thus be kept afloat when other appliances would fail. Mr. Walker has erected Engines for

the Parliamentary Commissioners for draining in Somersetshire, Norfolk, and in Lincolnshire. At the estate of Mr. Boult, Runham, Norfolk, a large tract of land has this year grown the finest corn, which had been hitherto uncultivated, from the impossibility of draining it by the means heretofore employed. The proprietors of estates in the West Indies have watched the completion of these Machines with much anxiety.—*Abridged from the Illustrated London News,* No. 288.

GALLOWAY'S ROTARY STEAM-ENGINE.

THIS unique little Engine is used to drive the blowing-machine at Mr. Tyrell's factory, at Deptford, which is stated to require about four horses' power; and this it performs with such energy as to leave no doubt that it possesses not only the force requisite for the work imposed, but something more. A tolerably correct idea of its size may be formed by comparison with the man in attendance; but, as it has been already described as about the dimensions of a "hat-box," it may be as well to state that the diameter of the cylinder outside is 18 inches, and the depth 8 inches. Within this works what the inventor calls "the piston;" but which, a piston, as ordinarily understood, conveys no idea of.

The cylinder and piston are 5 inches deep; the piston works on a crank, the centre of which is compelled to move round the middle circle, thus communicating a rotary motion to the pulley carrying the band. The steam is admitted by a pipe into the steam-chest, the opening into the working part of the cylinder being covered with a plate of metal, to which the piston is firmly secured, the centres of each revolving round the middle circle before referred to. Through this plate, on one side of nearly the extremity of each arm of the piston, are holes to admit the steam into the cells, and so arranged as to be opened and shut by the surface of the cylinder over which it passes in its eccentric revolution with the piston. The exhaustion is effected from the bottom of the cylinder, and the escape is at the pipe at the side. Practical workmen will appreciate this great excellence, and even the ingenious inventor may congratulate himself that the present development of mechanical skill has enabled him to perfect an invention which, had it been discovered thirty years ago, would, most likely, have failed for want of art sufficient to carry it out.—*Illustrated London News,* No. 290.

AMERICAN ROTARY STEAM-ENGINE.

MR. RUSSEL BURTON, of Annsville, N.Y., has patented a Rotary Steam-Engine, of a novel and deeply scientific construction. The Engine is so arranged, as to derive power in the first instance from the momentum of the inducted steam, as well as its full force of pressure which is exerted on the piston. The steam is regularly cut off at half stroke or less from one piston, and applied to another piston while acting expansively on the first: and the arrangement for exhausting is such as to operate by reaction on the pistons. Both the induction and eduction of the steam are through the main shaft, and arrangements are made for amply oiling the pistons and packing, when in operation.

THE TIDAL MILL.

THIS novelty has been moored a little below the Southwark Bridge, on the Borough side; and the attention of the curious and scientific has been considerably excited towards it by the strangeness of machinery without any visible motive power, being constantly in operation on its deck. This experimental vessel belongs to the "Tidal Mill Company." It is constructed in two parts; the space between is for the reception of a wheel 7 feet in diameter, with six vanes, each 5 feet 6 inches broad at the periphery, and tapering to 7 inches near the centre: it is like a screw-propeller, and is placed at right angles to the current, which gives it motion, the speed of which, it has been calculated, communicates power in the following ratio:—

Tide—miles per hour	2	3	4	5	6
Wheel, 7 feet diameter, working horse power	2	3	4	5	6
Do. 14 do. do. do.	8	12	16	20	24

On the circumference of the wheel is a rim of thin iron, carrying a band which drives a pulley on deck, and to which may be attached apparatus for sawing, or any other purpose.

On the Rhine, Seine, and other Continental rivers, floating Tide Mills have been most successfully adopted; whilst in this country only two instances occur of their having been attempted; and these, owing to the want of simplicity in their arrangements, failed to produce any useful effect.

If we can rely on the correctness of the above Table—which is said to be the result of *actual* experiment with the 7 feet wheel—there can be no doubt but that, at no very distant period, the public will avail itself largely of this cheap and enduring motive power, especially in the vicinity of the more rapid rivers, such as the Thames, Mersey, Severn, Humber, Tyne, &c.—*Illustrated London News*, No. 291.

SIMPSON'S PATENT SUBMERGED PROPELLER.

WHEN the first innovation was made upon the rights of the "ancient wicker fan," by the introduction of the four-vaned blower on the floor of the barn to create an artificial current of air; and when afterwards that same simple agent was inclosed in the drum of the winnowing machine, where a direction was given to the current by a volute form of casing—simple and cheap in its construction and application—giving out a breeze, just sufficient to drive off the chaff and nothing more—it was regarded as a mere apology for the "sturdy old bellows;" but now, after the lapse of upwards of a century, we find the whole troop of blowing apparatus, from the forge to the smelting furnace, rapidly retiring before their powerful though diminutive rival, which, having triumphed in one element, is now seeking to win fresh laurels in another; and that, too, with good chance of success, if we may judge from the results of a trial trip, made by Mr. T. B. Simpson, on board the *Albion* steam-vessel with his Patent Submerged Propeller, and reported in the *Times* to have acquired a speed of from ten to twelve knots per hour.

This Propeller is, as before remarked, the old blowing machine immersed in water, and acting on that element precisely the same as with air; *i. e.* collecting it in the centre, and throwing it off at the circumference of the vanes, from whence it impinges on a segment of a circle, placed so as to form a volute to the centre, and is by that made to leave the opening in a strong current parallel to the side of the vessel. This is effected by levers, by which the segment is attached to the upper and lower plates of the drum; so that when the motion is reversed, the action of the water against the inside of the segment throws it over. Thus there are four vanes, each 1 foot in length, and 18 inches broad, made to revolve either way. There is also a thin metal circle, forming the barrel to the drum, inside of which the vanes revolve; and this guides the projected water in either direction, by merely changing its position when the vanes are reversed. Altogether, this is a most important problem; and whether solved or not by the labours of Mr. Simpson, he has entitled himself to high credit for the indomitable perseverance and talent he has displayed in endeavouring to carry out a principle which he believes to be true, and which he has spared neither pains nor expense to prove. We heartily wish him success.—*Abridged from the Illustrated London News*, No. 291.

AUXILIARY STEAM-POWER FOR VESSELS.

Mr. Grantham has read to the Institution of Civil Engineers, an important "Account of the Sarah Sands, and other Iron Vessels, with direct acting Auxiliary Engines and Screw Propellers." The object of the paper was to show that a propeller might be constructed of such dimensions, that the number of revolutions it would require to make, in order to obtain a high velocity, would not much exceed that of the ordinary paddle wheel; and that hence the usual marine condensing engine might be applied direct to the propeller shaft without the intervention of a secondary motion. It appeared from the statements in the paper that Woodcroft's expanding pitch screw propeller was the best form that had hitherto been employed. In a paper read to the Institution upwards of three years since, Mr. Grantham gave his views on this subject: and several vessels had been since built, the results of the trials of which were now communicated. The principal of these were the Emerald and Diamond, three-masted schooners of 300 tons and sixty-horse power—the Nautilus of the same dimensions—the Antelope of 600 tons and 100 horse power—and the Sarah Sands of 1000 tons and 180 horse power. The capabilities and performance of these vessels were described; but particular notice was taken of the last—which had performed a most successful voyage to New York during bad weather and adverse winds. The passages made by the ordinary New York liners which were out at the same time were very long, averaging forty-eight days each; and the Boston and Liverpool steamers were much longer than usual on their passage. The Sarah Sands used her steam about seventeen days,—and sailed the remainder; making her voyage in twenty days and ten hours. On her arrival she had about enough fuel remaining for four days' steaming.

EXPANSIVE ACTION OF STEAM.

Mr. J. M. Heppel has read to the Institution of Civil Engineers, a paper, "On the Expansive Action of Steam." Its chief object was to deduce a more exact formula than those now in use for the dynamical effect developed by steam in expanding from one pressure to another. Mr. Heppel combines Pambour's formula with one by Mr. Scott Russell, expressing the relation between the pressure and temperature; and by this means eliminates the latter, and obtains a formula containing only the pressure and density. From this formula another is easily obtained, showing the total dynamical action developed during expansion from one pressure to another; and the results were given in a tabular form, exhibiting: 1. The pressure in pounds per square inch. 2. The relative volume or ratio of the volume of steam to that of the water which produced it. 3. The dynamical effect before expansion, or the number of pounds raised one inch by the evaporation of each cubic inch of water. 4. The dynamical effect during expansion, or the number of pounds raised one inch by the steam produced from one cubic inch of water in expanding from a pressure of 100lbs. per square inch to the particular corresponding pressure. The dynamical effect in expanding from any one pressure to any other must be clearly expressed by the difference of the corresponding numbers in this column. Part of the remainder of the paper was devoted to showing, that, whilst the performance of engines could not possibly be expected to exceed the results ascertained as above, it should not fall far short of them in the case of engines of good construction. In the course of the communication,, the fallacy of the theory of what had been termed the "percussive action" of steam was ably exposed; and although from the paper being full of mathematical formulæ it was not well adapted for being read at a public meeting, it evidently possessed great merit as an investigation of an important subject.

This communication was followed by a short paper, also "On the Expansive Action of Steam," by Mr. Tate,—the object of which was to demonstrate and apply a formula some time since discovered by the author, expressing the law of the Expansion of Steam: and at the same time to establish certain general equations relative to the work of steam applicable to all formulæ professing to give the law of volume and pressure. It also examined and corrected Pole's formula, which, although a decided improvement upon Pambour's, was stated to be not sufficiently accurate for pressures above seventy pounds or below sixteen pounds.—*Literary Gazette, No.* 1586.

NEW STEAM-GAUGE.

Mr. Smith, of Nottingham, has patented a Gauge for Indicating the Strength of Steam-Engine Boilers, which Mr. George Stephenson, who has examined it, describes as a "most important invention." It is particularly adapted for steam-boats, and can be placed in the cabin, on deck, or on any other part of the vessel, where it may be seen by every passenger on board. It may also be fixed in the office of every manufactory where a steam-engine is used, at a considerable distance from the

boiler. Mr. Stephenson has put one up at one of his own collieries; it is some distance from the boiler, and in another house; it works most beautifully, showing the rise and fall of the steam in the most delicate manner. The indicator is like the face of a clock, with a pointer, making one revolution in measuring from 1lb. to 100lb. upon the square inch of the pressure of steam; it is quite from under the control of the engineer, or any other person, so that its indications may be relied upon, and the construction is so simple that it is scarcely possible for it to get out of order.

STEAM HELVE.

Mr. Smith, of the Vulcan Works, West Bromwich, has invented a Steam Helve, the principal feature of which is the economising of the steam, by having a small engine to work the force-pump during the heating of the iron undergoing the process of forging, and so reserving the steam till the work is ready to commence upon. The mode of action is by means of a steam cylinder, placed directly over the head of the hammer and the piston of the cylinder, connected to the hammer; the steam is applied to lift the hammer up, which descends by its own weight on the work.—*Mechanics' Magazine*, No. 1269.

INCRUSTATION IN STEAM-BOILERS.

Mr. F. J. Delafosse, of Paris, has patented, for preventing and removing Incrustation in Steam-boilers, a compound to be used, mixed with the water, for the purpose of preventing the precipitable matters contained in it from incrusting the boiler. The substances forming this compound are, first, dry tannic or gallic extract, obtained from oak, gall-nuts, or any other substance yielding it; secondly, muriate of soda; third, hydrate of soda; and fourth, subcarbonate of potass. These ingredients are mixed in certain proportions, varying with the nature of the water (which is to be first analysed, to ascertain the quantity of precipitable matter contained in it) and also according to the boiler, whether stationary or locomotive. For a stationary engine, the patentee recommends for 336 hours' supply of fresh water per horse power, a compound of twelve ounces of muriate, two ounces and a half of hydrate of soda, two drachms of dry tannic or gallic extract, and half an ounce of subcarbonate of potass; but if salt water be mixed with the fresh water, or sea water be used in the boiler, then the muriate of soda is to be omitted, and six ounces of hydrate of soda is to be used instead of two ounces and a half, and five drachms of tannic extract instead of two. For locomotive engines, running on the average 140 miles per day, the patentee increases the above proportions about one-fifth. The compound to be added at intervals, viz. a portion every day, or every two or three days: in stationary engines it may be added to the boiler at once, and in marine-engines it may be mixed with the water in the boiler, or in the feed tank; but in locomotive engines, it is better to mix it with the water in the tender.—*Patent Journal*, No. 42.

DR. RITTERBRANDT'S PROCESS FOR PREVENTING THE INCRUSTATION OF STEAM-BOILERS.

THE *Times* bears the following testimony to the merits of this process :—"The invention has been tried for nearly twelve months upon the boilers of the engines printing the *Times*, working on an average seventeen hours *per diem* throughout the year. Not only have the boilers been kept perfectly free from deposit, but an incrustation, which was formed previously to the application of the invention, has been completely removed. We can further state, that neither the boilers nor any part of the machinery has been in any, even in the slightest degree, acted upon or injured by the action of the remedy in question." The Institute of Civil Engineers have awarded a Telford medal to Dr. Ritterbrandt for his discovery, and he had previously the honour of receiving the gold Isis medal of the Society of Arts.

MAGNETIC STEAM-GAUGE.

THE construction and operation of this instrument are very simple, and will be fully understood, both in character and importance, from the following preamble in the words of the inventor :—

"The importance of a reliable means of indicating the height of water in steam-boilers is now universally admitted by engineers, for the reason indicated by science and established by experience, that the deficiency of water in boilers is the principal, if not the only, source of explosions; and hence the many attempts which have been made to obtain an apparatus for this purpose, which, whilst it can be relied on, will at the same time be in such a condition as to insure the observance of the engineer. But, so far as I have been informed, all the attempts heretofore made have failed, because of the difficulty of forming the connection between the water inside the boiler and an indicator, which, to be practically available to the engineer, must be outside. A float, resting on the water, and communicating with an index, a lever, or other device outside, through a stuffing-box, has generally been resorted to; but it is evident that the friction of the stuffing-box will prevent the working of such an apparatus, which must be sensitive, and which necessarily possesses very little power, as the buoyancy of the float is its only actuating force. To avoid this difficulty, attempts have been made to put the indicator within the boiler by covering it with glass, but with as little success; for the action of high temperatures, it is known, renders the glass opaque.

"My invention, it is believed, will avoid all these difficulties; and it consists simply in attaching a magnet to the axis of motion of a wheel or lever, to which the float is suspended or attached, to communicate motion by attraction and repulsion, to an index-needle turning on an axis outside the boiler, and separated from the magnet by a steam-tight plate."—*Report of the American Commissioners of Patents: Mechanics' Magazine*, No. 1225.

FUMIFIC IMPELLER.

THIS is an invention of Mr. Alexander Gosdon, intended by him "to supersede the steam-engine for navigation. The principle upon which

Mr. Gordon's method of moving bodies is based, admits of no doubt, viz. that machinery, whatever may be its beauty, cannot add to the power of heat as the prime mover. And should he succeed in practically carrying out this principle, making "fumific impulse," or the discharge of the hot products of combustion, the moving power, the steam-engine, with its paddles or screw-propellers, will have have seen its day. He says that he has succeeded in a boat twenty-six feet long and four feet and a half broad; one man blowing a common small forge bellows doing the work of two rowers. The bellows entered into a close furnace, luted, and fitted tight; and each stroke passed air through the close fire, the hot products rushing out against the water by a discharge pipe, immersed twelve inches. "The first blast by one man always started the boat (weighing nearly two tons), from a state of rest, three feet in two seconds," the fire, and one man blowing air, doing the work of two men; hence it follows, that suitable close furnaces, blown by a fifty-horse power steam-engine, will do the work of 100 horses in impelling the vessel, and so on in proportion: so states Mr. Gordon.—*Literary Gazette, No.* 1586.

NEW BLOWING-MACHINE.

In No. 1225 of the *Mechanics' Magazine*, it is stated, that M. Heinrich Beinhauer, smelting factor, of Sounbrau, near Elberfeld, in Rhenish Prussia, has invented a new Blowing-machine, which gives a constant pressure, as indicated by the anemometer, and requires no regulator whatever. The blast produced by it is sufficient to pervade the column of a smelting furnace, with equal intensity, at all points and times. A machine of this kind, measuring eleven feet six inches by twenty-two feet nine inches, with a pressure of forty ounces on the square inch, and a horse-power of seventy, will furnish 6028·8 cubic feet of wind per minute, and after that rate for smaller dimensions.

A NEW GAS-ENGINE.

An engine on a new principle has been invented by a Mr. Perry, of Herkiman, United States: it evinces an astonishing power in proportion to the minute quantity of material from which the power is produced. The machinery consists, in part, of a cylinder, piston, pitman, fly-wheel and governor; in this respect similar to a steam-engine. A small quantity of spirits of turpentine is kept in a warm state, and the vapour arising therefrom is mixed with fifty times its volume of atmospheric air. A small proportion of this hydrogenated air is drawn into the cylinder and ignited by a movement of the machinery, producing a slight explosion, whereby the remaining air,—at least nine-tenths of the whole,—becomes so heated that it drives forward the piston with great force by its expansion. This engine is said to be capable of working ten horses' power; it is intended to substitute rosin instead of turpentine, which will reduce the expense of feeding it to about fifty cents. per day.—*New York Journal.*

TAYLOR'S MARINE CAMELS.

By means of this invention, experimentally at New York, a vessel of

the largest class has been taken over a bar, which she could not possibly have passed in any other manner. The plan has been very favourably reported by the American Institute; and it is added, that not only can these Camels be used to lighten vessels over sand bars, and to get off those that may have been stranded, but by being inflated and placed in the hold of a ship, they will keep the heaviest craft from sinking, and thereby be effectual in preserving life as well as property. The Camels will, undoubtedly, be the most gladly welcomed by the sailors and shipping merchants of the great lakes, where sand bars are so abundant and dangerous.

NEW BEACON ON THE GOODWIN SANDS.

During the summer there was erected another Beacon on the South Calliper of the Goodwin Sands. The centre column was a tube of cast iron, two feet six inches in diameter, put together in ten and twenty foot lengths; it was inserted thirty-two feet deep into the sand, by means of Dr. Potts's newly invented process of atmospheric pressure; the four surrounding tubes were of fifteen inches diameter; the whole was bolted together, and surmounted by a cage of seven feet diameter, the top of which was fifty-six feet above sand level.

The process by which the foundation of this new Beacon was secured is this:—Hollow tubes or piles are employed, which may be formed of any material, and almost of any shape. The lower extremity of the pile is open, and the upper one fitted with a cover. It is placed upon the bank or ground, whether composed of sand, shingle, mud, clay, bog, or other material, in any moist situation, or under deep water. From the tube or hollow pile the air is extracted by pumps, the condensation of steam, or any mode effectual in producing that action which we call suction; being, in fact, the removal of the pressure of the atmosphere, or the partial formation of a vacuum.

When the air becomes sufficiently attenuated, the shingle, sand, or mud, flow up through the tube or hollow pile, the rush of water from below breaking up the natural arches which solid particles form together, and undermining the lower edges of the tube, which then descends by its own gravity, and the pressure of the atmosphere on its upper extremity. As often as the pile or tube is filled, the contents are discharged by a suction-pipe, or other means; and not only the solid particles, but the water, may be removed to the depth of thirty feet. It is obvious that the particles of sand, or other solid matter, may be removed from the interior of the tube to a much greater depth, provided the water be freely admitted to the interior of the tube. The importance of the time gained in extensive works is obvious. A succession of tubes may be added to the first, by means of screw, flange, or other joints. The shape of the tubes may be cylindrical, angular, or conical, so as to fit each other, and form a continuous line, or wall, and may vary in size from two inches to fifty feet.

In works where an insular or detached erection may be required, as in the commencement of a breakwater, at the depth of several fathoms in the sea, tubes of very large diameter may be used: or a series of them may be fitted to form, as it were, staves of a vat of vast dimensions, con-

fined together by hoops and bolts, gradually put together in the water. The tubes may be floated to the spot where the insular rock is required, and there sucked down, thus penetrating any sand or shingle that may occur, so as to secure a firm foundation in any bottom. After nearly one hundred experiments on cements setting in or under salt water, some cheap varieties have been found, which at once unite shingle and large stones into a perfectly solid rock. Into this composition masts or wrought iron bars may be inserted, and the weight such structures will sustain is shewn by experiment to be enormous. Thus, nineteen piles of one foot in diameter support a pier of the stone viaduct erected by the Chester and Holyhead Railway Company over a branch of the sea in Anglesea.

Our readers will perceive the value of this discovery, in the formation of foundations for the construction of harbours, docks, railroads, bridges, lighthouses, batteries, &c., is dependent on the ease and rapidity with which it may be applied, not only where the ordinary modes of proceeding are of difficult execution, but when the employment of the means hitherto known is practically impossible.

By a certificate from the Trinity Board, it appears that a tube of two feet and a half diameter was forced, by Dr. Potts's process, thirty-five feet into the Goodwin, where Admiral Beaufort could only force down a steel bar eight feet with a sledge hammer. Captain Bullock, R. N. found that a pointed iron rod of three inches diameter, at the depth of thirteen feet in the sand, took forty-six blows of a monkey of one hundred weight, with ten feet fall, to drive in one inch.

These facts demonstrate how erroneous is the popular notion that the Goodwin Sands are readily penetrable from their surface to the chalk on which they rest.—*From the Illustrated London News*, No. 285.

We regret, however, to add, that during one of the autumnal gales, the above Beacon was entirely swept away,

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DRAINAGE OF HAARLEM LAKE.

We learn from a source on which we can rely, that the Drainage of Haarlem Lake, in Holland, progresses satisfactorily, and that other engines, with improvements, are now constructing in Cornwall, to hasten the completion of that great work. When finished, it is understood, the sewage of all the cities and great towns bordering on the lake will, by the same engines, be conveyed to and over the surface of the bed of the lake to irrigate it; so that, in all human probability, 56,000 acres, now covered with water, and the waste land adjoining, will, within the next seven years, be furnishing corn and cattle to the Dutch and London markets—the result of science combined with practice. We learn also, that the same parties who are engaged in this magnificent undertaking are in communication with the Egyptian government, on the subject of employing similar engines to irrigate districts above the ordinary rise of the Nile, for the purpose of growing cotton, flax, &c.

We quote this information from the *Mark Lane Express*. A very interesting account of these stupendous Drainage works will be found in the *Year-book of Facts*, 1847, pp. 34—38.

SEA WALLS.

At a late meeting of the Institution of Civil Engineers, the comparative advantages and disadvantages of vertical and sloping Sea Walls were discussed; and instances were given of the effect of seas upon the former, when Walls of a certain batter, or curved face, were surmounted by an overhanging coping, of such extent as to deflect the curling wave outwards, and throw it back upon itself, rather than to let it fall bodily inwards, as in the case of the Penmaenmawr Wall. The manner in which the waves were driven up long slopes, acquiring force as they travelled along, was contrasted with this. On the other hand, the action of the various kinds of waves was shewn upon sections of the beach at Madras, where the surf was so notoriously bad, and where it appeared that by the clawing off of the waves the beach was washed away into natural steps, of a level, and then a small slope of forty-five degrees. A breakwater had been formed off that beach, by throwing in loose masses of rock, forming their own slope; this, when carried up to within ten feet of the water level, stood well.

In Knootker Sound the same effect of the drawback of the waves was noticed. Sections of the mole of Venice were shewn. That mole, which is nearly sixteen miles in extent, had a section of a sloped foreshore, with a nearly vertical wall, then a slope at another angle, and above high-water mark another nearly vertical wall. When the seas rolled in upon the mole, they partially curled over against the first wall, and were projected with augmented force against the upper one. The consequence was, that the mole was partially destroyed; and in the repairs, which had been executing for some time past, it had been reduced to one uniform sloped face, at an angle of about fifteen degrees. The destruction of the nearly vertical walls of Portpatrick was also noticed. Those walls, although constructed of the finest Anglesea lime-stone, well dressed, dovetailed, and tied down vertically and horizontally by iron-chain bonds, were completely overthrown; and, until the thickness of the wall was increased to eighty feet of solid material, it could not be made to stand. The situation was extremely exposed, and the sea frequently sprung fifty feet above the top of the lighthouse, which was itself sixty feet above the level of high water of spring tides.

The causes of the peculiar action of the drawback of the waves, as exemplified by the removed shingle from the beach when the wind was on shore, and its accumulation when the wind blew off shore, were also discussed; and it grew to be the received opinion, that in these cases, the upper part of the waves being acted upon by the wind, a peculiar rolling motion in a counter direction was imparted to the lower wave, which acted upon the shingle in the manner alluded to. This action appeared, however, only to extend to a depth of about nine feet, which it seemed to be agreed was the ultimate depth of detrimental action of all waves. The effect of advanced groynes in protecting Sea Walls was exemplified by the Concrete Walls at Brighton and Dover, which were intended merely for retaining walls; and such was the effect of the groynes, that since they had been put down, the shingle had accumulated to such an extent, that the

sea did not approach injuriously to within one hundred feet of the base.—*The Builder*, No. 214.

WARNER'S "LONG RANGE."

THE secret of the Warner Long Range has ceased to be a secret; and depreciated vastly from the nominal value which was attached to its mysterious promises. Copies of the instructions given by the Board of Ordnance to the officers appointed for the examination of the invention, and of the Journal of the Proceedings of the officers so appointed, have been distributed among the members of the House of Commons. The vehicle of the captain's exterminating missiles turns out to be a balloon of ordinary construction; and the arrangement by which these are made to explode at the desired time and place is the only portion of the mystery in the keeping of its inventor. As to the value of that portion, and the success of the experiments by which it was tested, opinions are as yet divided. The commissioners would seem to report by inference against it: but it is fair to state that Lord Ingestre, on whose admission of failure the inference in the report is based, has written to Lord John Russell denying his concurrence in any such conclusion, and proclaiming his undiminished faith in the destructive shells of Capt. Warner.—*Athenæum*, No. 1020; May 15.

From the above official document it will be seen, that the desire of the Commissioners has been to bring this long-standing question to a fair and practical proof, by giving Captain Warner every facility of exhibiting his invention consistent with their public duty. The amount of Captain Warner's own estimate was furnished him by the Government, the place of operation was chosen by himself, and also the direction of the object to be operated against. Finally, after Captain Warner had stated his preparations were complete, five days had elapsed before all circumstances suited his perfect convenience, and were favourable for making his experiments. Thedocument adds:—"We have now the honour to report that this trial proved a failure, and, having given the subject our most serious consideration, we are of opinion, that, from the difficulties attending, and from the complicated nature of the mode of operation and the uncertainty of the precision of aim, the invention of the Long Range cannot be made available for the general purposes of war; and we beg further to remark, that the principle of action will always be discovered on the first exhibition."

GUN TOW APPLIED TO BLASTING.

A MANUFACTURER of Gunpowder, in the west of Scotland, who has of late turned his attention to the manufacture of Gun Tow and Gun Saw-dust for blasting purposes, has experimented on some whinstone rocks of the most solid description, at the Lady Mill Quarry, in the presence of Professor Penny, and a number of other scientific gentlemen. The first experiment was in a bore of three feet in length, and two-and-a-quarter inches diameter, which was charged with nine ounces of Gun Tow, (three pounds of gunpowder would be required to fill the bore necessary to blast). The effect was the bringing down all the rocks adjacent, to the extent of about ten tons. The second experiment was with a bore of

three feet four inches, and two-and-a-half diameter, and was charged with eleven ounces of Tow and Cotton mixed (four pounds of gunpowder would be required). The effects were fully more apparent of its strength than in the previous case, bringing down about thirteen or fifteen tons weight.

DR. JAGER'S PATENT IMPROVEMENTS IN FIRE-ARMS AND CARTRIDGES.

There are two leading features in Dr. Jager's improvements which distinguish his system of projectiles most favourably from all others vet brought before the public. First, he dispenses both with loose priming and percussion caps—does away in fact with priming altogether, reducing gunnery to the two operations of loading and firing, whereby a much greater number of shots can be discharged in a given time. Secondly, he makes biting off the ends of cartridges (a most pernicious practice) unnecessary, by constructing his cartridges of a peculiarly-prepared paper, which takes fire as quickly as powder itself, and burns without any residuum, (none at least of any practical consequence) leaving the gun after each shot perfectly clear for the subsequent loading.

The supercession of the priming is effected by causing every cartridge to carry its own priming. The top or powder-end of the cartridge terminates in a small projecting nipple charged with fulminating powder, which on ramming down the cartridge drops into a recess made for it in the breach of the gun, (but without reaching to the end of that recess), and is completely protected by a shoulder-piece in front of the recess, from the percussive action of the ramrod. In the top of the recess there is an orifice, through which a hammer attached to the cock of the gun descends on drawing the trigger, and, striking the nipple of the cartridge, causes the instant discharge of the piece. The illustrated details of these improvements will be found in the *Mechanics' Magazine*, No. 1225.

CONGREVE ROCKETS.

Congreve Rockets were introduced into the service during the late war, and were first employed at the attack of Boulogne, in 1806, by Commodore Owen. These missiles are contained in metallic cases, the carcases with strong iron heads filled with a composition as hard and solid as iron itself. The penetration of a 32-pounder rocket carcase in common ground is nine feet, and it has been found, in the different bombardments where they have been used, to pierce the walls of solid mansions, and pass through the several floors. * * The Congreve Rocket must be looked on as exclusively a British weapon, and its internal structure and composition are as yet maintained in profound secresy. The French, who have been greatly disconcerted by the introduction of this projectile, pretended more than once to have analysed some of the rockets, and thereby discovered the art of making them; and the Americans boast that they can make them,—better, of course,—than we do at Woolwich. But there is little assurance in asserting, that the foreign chemists are, to a man, at fault; for it is confidently maintained, by those who are behind the curtain, that the art of making these rockets cannot be discovered either by inspection or analysis.—*United Service Magazine.*

ROBERTS'S SUSPENDED MORTAR.

Some important experimental trials have been made at Portsmouth, with Lieutenant Roberts's (Royal Marine Artillery) invention of firing a twelve-inch Mortar, suspended between two stanchions, instead of using the present mode of having it fixed in a solid bed on the deck of a ship. Upwards of twenty shells, filled with sand, were fired, the greater number with the full charge of twenty pounds of powder. When fired, the Mortar described an arc of sixty degrees, and on regaining its position was at forty-five degrees. After each discharge, the vibrations never exceeded fourteen seconds before the Mortar was again steady, and the concussions were so slight, that a glass was placed under the Mortar and not broken. The rolling of the vessel on board which the experiments were made, did not alter the position of the Mortar. The plan of fitting a Mortar on Lieut. Roberts's principle is so simple, that in case of bad weather the whole of the apparatus can be shifted from the upper to the lower deck of a vessel in five minutes. The expense of fitting is trifling, and the working does not require any additional number of men.

PORTABLE CANNON.

The American papers mention a new sort of Cannon, invented by a Mr. Fitzgerald, which is so constructed that it may be carried by hand or on horseback over mountains, forests, or marshes, where an ordinary cannon would be altogether useless. It consists of a series of circular perforated plates of the best wrought iron, 1-4 to 1-2 inch thick, with well-planished faces, which are arranged in contact, and are connected together by wrought iron rods or bolts, passing through holes near the periphery; the bolts having strong heads at one end, and a screw nut at the other, whereby the plates are firmly held together. Several of the plates at the breach are, of course, solid, and without the hole in the centre. The series being thus connected, they are bored and polished inside, and turned off to the proper shape outside. While this cannon is stronger than those of common cast iron, it can readily be dissected, and each section may be shouldered by either pedestrian or equestrian artillerists; and when required, the parts may be put together and secured ready for action in ten minutes.—*Mechanics' Magazine*, No. 1254.

PROJECTILE FORCE.

M. Matter has communicated to the Academy of Sciences at Paris, the result of some experiments on the Expulsive Force given to Projectiles in cannon, muskets, &c., by different charges of powder. They are as follows:—first, that within certain limits the force communicated is in proportion with the charge of powder; secondly, that with slight charges the force is greater in proportion as the touch-hole is small, by which means less of the explosive gas escapes; and thirdly, that with muskets this law is invariable with charges of powder which exceed one-half the weight of the projectile.

LORD DUNDONALD'S PROJECTILE.

On official trial, it has been proved that by this invention a conti-

nuous evolution of gas may be made to project shells or shot from a tube, on an average in throwing twenty-five 6-pounder shot to the distance of 7000 yards. From these data it is clear that balls of greater diameter would far exceed the range of common artillery. Another important advantage is said to accrue—namely, that the continuous rush during their emission would prove much less injurious to vessels projecting such missiles than the shock or recoil of single discharges. We learn that Lord Dundonald's ingredients produce an elastic emission, like that which would be evolved by kindling the end of a hawser or cable formed of hard-twisted gun-cotton.—*Hampshire Telegraph.*

ON GUNPOWDER.

Prof. Faraday has read to the Royal Institution, a paper "On the Manufacture and Properties of Gunpowder." Prof. Faraday briefly noticed the known composition of Gunpowder as consisting of—

75 parts of Nitre;
15 „ Charcoal
10 „ Sulphur;

which, converted into equivalents, give—

1 of Potassium
1 „ Nitrogen
6 „ Oxygen
3·4 „ Carbon
0·85 „ Sulphur

in a state of mechanical mixture. He then proceeded to advert,

1st. To the *manner of the action of Gunpowder*. Gunpowder was described as a solid body, in which a source of enormous power was locked up, capable of being brought into immediate operation whenever wanted; the action thus elicited being itself regulated by human skill with wonderful precision. The respective functions of the sulphur, nitre, and charcoal, in producing the effects of Gunpowder, were experimentally shown. The enormous quantity of gas generated by the combustion of Gunpowder, irrespective of heat, was exhibited. It was remarked that, on the ignition of Gunpowder, though the sulphur begins the combustion, it is not itself burned by the oxygen of the nitre, but unites chiefly with the potassium of that salt to form sulphuret of potassium,—a substance which assists in giving to the flame of Gunpowder an intense heat.

2dly. The *amount of heat required for the inflammation of Gunpowder* was next adverted to. If Gunpowder and steel filings be dropped together through four or five inches of flame, the latter will burn, though the former will not. A flame from gas was made to play for several seconds on a heap of Gunpowder, without lighting it; but, 3rdly, *when actually lighted, Gunpowder evolves very great heat.* It is to the immense heat produced on the solid products of the combustion of Gunpowder, that the certainty of its complete combustion is greatly owing. In this respect Gunpowder differs characteristically from gun-cotton. The latter fires at a heat which would not affect the former; but produces, by its combustion, a degree and condition of heat much less communicable to other bodies.—4thly. The *effect of the heat generated, independent of the chemical change from the solid to the gaseous or*

vaporous state, namely, that due to mere expansion or increased elasticity producing the effects of Gunpowder, was adverted to. This was illustrated by the violence with which a mixture of one volume of oxygen with two of hydrogen gas bursts the vessel which contains it, solely in consequence of the heat elicited during combination. This is manifest from the fact that the space occupied by the uncombined gases is greater by one-half than that taken by the resulting steam.—5thly. Prof. Faraday laid great stress on the *effect of the granulation of Gunpowder*. To this condition of Gunpowder, presenting, as it does, a number of separated surfaces of size just sufficient to become surrounded with flame at the same instant of ignition, much of the disruptive or projectile effect of Gunpowder was ascribed. It was shown that, without that porosity which its division into grains imparts to a mass of Gunpowder, the explosion of the whole could not be instant nor simultaneous. This was proved by bringing a piece of mill-cake successively into the condition of grain powder and of meal powder. The slow combustion of the solid meal powder fuse was compared with the quicker inflammation of the hollow rocket and the instant inflammation of the charge of a gun. All these effects are related to the condition of the interior of the Gunpowder, in respect of its permeability by the flame of the first particles ignited. Then, as to its exterior condition, it was shown that the tardy burning of the miner's fuse is due to the granular state of the powder in its case being counteracted by the pressure of the strands of rope wrapped very tightly round it; while, on the other hand, in the cracker of the firework-maker a similar train is instantly fired throughout, because it has a loose jacket all over it, and, in the burning of the common cracker, an alternation of these effects is produced.

In conclusion, Prof. Faraday dwelt on the great importance of *time* in producing the effects of Gunpowder. Contrasting the action of Gunpowder with that of fulminating-mercury and silver, or of those still more fearfully explosive compounds, the chlorides of nitrogen and of iodine, Prof. Faraday showed, that, if the explosion of Gunpowder were really instantaneous, it would be useless for all its present applications. As it is, however, whenever Gunpowder is fired in the chamber of a gun, it does not arrive at the full intensity of its action until the space it occupies has been enlarged by that through which the ball has been propelled during the first moment of ignition. Its expansive force is thus brought down and kept below that which the breach of the gun can bear, whilst an accumulating, safe, and efficient momentum is communicated to the ball, producing the precise effects of gunnery. This manageable action was contrasted with the effect of a morsel of iodide of nitrogen put on a plate, and exploded by being touched by the extremity of a long stick. The parts immediately in contact with the iodide were shattered—*i. e.* the end of the stick was shivered, and the spot in the plate, covered by that substance, was drilled as if a bullet were fired through it, yet no tendency to lift the stick was felt by the hand,—whereas the comparatively gradual action of Gunpowder lifts and projects those weaker substances, wadding and shot, which give way before it.—*Athenæum*, No. 1005.

NEW VENTILATING APPARATUS.

Mr. Emerson, of Boston, has invented an apparatus which will apparently give an uniform direction to a current of air, either upward or downward, as desired. He has discovered two Ventilators, one of which, by being applied to the end of a tube and exposed to the outward air, will cause, uniformly, a descending or inward current, and the other, an ascending or outward current of air; and this, too, whatever may be the force or direction of the wind. Mr. Emerson believes that with this simple apparatus he can ventilate a ship's hold, from stem to stern, even down to the kelson; and thus remove the noxious gases which often generate in the course of long voyages.

HOUSE VENTILATION.

Mr. Toynbee, F.R.S., has read to the Institute of British Architects, a paper "On Ventilation," in which, after proving from various statistics, that disease is the rule, and health the exception, the lecturer submitted the following propositions for the adoption of Government to the consideration of the Institute:—1. That no living, sleeping, or work-room shall contain less than 144 superficial feet, or shall be less than eight feet high. 2. That such room shall have one window at least, opening at the top. 3. Also, an open fire-place. 4. That in every living, sleeping, or work-room erected in future, some method shall be adopted of allowing the foul air to escape from the upper part of the room. He then showed the practicability of carrying out this provision, either by the introduction of Arnott's valve into the chimney, thousands of which were at this time in operation, and which might also be adapted to existing chimneys without fear of smoke, by the addition of a simple contrivance which he described, or a distinct channel might be made for the purpose. As a proof that ventilation must largely conduce to the prevention of disease, he stated that during the past year there was a diminution of nearly 800 in the number of sick applying for admission to the St. George and St. James's Dispensary; and it was believed that this, in part at least, was due to the improvement made by the Samaritan Fund attached to the dispensary, in ventilating the abodes of the poor in the district. 5. That every such room erected in future shall have some means of continually admitting fresh air. 6. In every public building in which gas is used, to insist upon the use of plans to carry off the products of combustion, and not to allow them to escape in a room. Various plans, having this object, are in operation in hundreds of shops, and may be seen in many shops in Regent-street. By their use, not only are the goods in the shop saved from injury, but the health of the people is improved. He was happy to hear, that in Covent-Garden Theatre not a particle of the products of combustion from the gas was allowed to enter the theatre. 7. That all churches, schools, theatres, workshops, workhouses, and other public buildings, shall adopt such methods of ventilation as are approved by the medical officer of health.

Mr. Toynbee then illustrated how these desirable objects were to be carried out, and showed that every house and room must be so arranged, that it can be supplied with fresh air to replace the vitiated air which has been

removed. Prof. Hosking had carried out these plans in every part of his house; and until they were general, the diseases dependent upon the want of ventilation must be a scourge to society. He observed, that in all the stables now erecting, admirable plans of ventilation were adopted.

VENTILATION OF MINES.

Mr. Joshua Richardson has communicated to the Institution of Civil Engineers, a paper on this important subject. The nature of the gases which exude from coal in the progress of getting the carburetted hydrogen, the olefiant, the sulphuretted hydrogen, and the carbonic acid gas, were severally treated of. The paper dwelt on the present methods of Ventilation, and the objections to them; illustrated, by quotations from the best authorities; all of which went to show, that in spite of the care and attention that had been given to the question, the skill of the engineers, and the introduction of the safety-lamp in 1816, the loss of life had been greater since that period than in a corresponding period previously. This must not be charged entirely to the lamp; for, although it may have rendered men bolder, and induced them to trust too much to it in venturing into those parts of the mines which formerly would have been abandoned, it must be borne in mind that as the coal is got at greater depths and distances from the shafts, the ventilation becomes more difficult; and from the greater number of persons employed in one mine, if an accident does occur the loss of life is greater in proportion. The merits of the safety-lamps, produced almost simultaneously by Sir H. Davy, Mr. G. Stephenson, and Dr. Reid Clanney, were canvassed; and the greater amount of merit, as well as the credit of the first production of it, appeared from evidence to be due to Mr. Stephenson. The author entered into calculations showing that the dimensions of the upcast shaft should, in all cases, be increased in proportion to the augmented volume of the air from the expansion in the higher temperature at which it leaves the mine after traversing all the passages; and if this were attended to, not only would the general ventilation be better, but in the event of an accident occurring, by an explosion or the derangement of some of the air passages, from falls of the roof, &c., an extra power could be applied, which would, at any rate, prevent a portion of the loss of human life which now occurs. It was maintained that, although in certain cases of fiery mines some improvements might be advantageously introduced, in the majority of the good mines the present methods suffice to keep them in a healthy and safe state; and that in almost all cases, it is the culpable neglect, not the want of means of prevention, that causes the destruction of health, life, and property, in the mining operations of the kingdom.—*Athenæum*, No. 1013.

VENTILATION OF THE NEW HOSPITAL FOR CONSUMPTION, AT BROMPTON.

The following are the details of the mode adopted by Dr. Arnott, in the above establishment:—"For ventilating purposes, air may either be *drawn* in and out, or driven in and out. In the present case, as the more economical mode, the second has been adopted, and the rotatory fan and the screw are the instruments employed. Dr. Arnott has derived the

main idea of his plan from an apparatus invented about a century ago by the Rev. Dr. Hales. It consisted of a bellows-like chamber, with a tube and nozzle, through which the air was expelled into the chamber to be purified. The machine was very generally employed in the English and Danish navies, but was ultimately abandoned, because of the labour required to force the air through the narrow nozzle and pipe. One-half the ship's crew were required to ventilate the other half. Dr. Arnott saw the advantages of this contrivance, and perceived, also, that he could dispense with the enormous power required to propel the air, simply by enlarging the area of the nozzle to the same calibre as that of the main box. The application of steam power also renders the apparatus complete. It now consists of two wooden quadrangular boxes, in which two hollow pistons move up and down alternately, by means of a rod attached to either end of a wooden beam, on the principle of a steam-engine. The beam is moved by a steam-engine of about one-horse power. When the wooden piston descends in the box, a valve opens in the upper half of the box, through which the air is admitted; when the piston ascends, the valve is closed, and the air is propelled into a central chamber. The same effect is produced in the lower half of the box; and thus, in both boxes, each ascent and descent of the piston impels a quantity of air into the central chamber situated between the two. From the central chamber the air rises into another apartment, filled with plates of copper, heated by an adjacent fire. These are placed at distances of half an inch from one another, and the air passing between them is thus raised to the desired temperature. The warm atmosphere now passes into a large tube, which ascends to the top story of the building, but in its course gives off a branch at each flat or landing. These are divided into ramifications, the narrowest of which go to the nearest apartments, and the widest to the most distant. They run along the skirtings of each room, into which they open by valvular fissures. The impure air of each room escapes by other valvular apertures, opening into the chimney as high as the ceiling. The apparatus is said to be capable of throwing into the building *three thousand* cubic feet of air, which, as the hospital contains a hundred inmates, is an allowance of twenty cubic feet per minute to every person.—*Communicated to The Builder*, No. 243.

VENTILATION OF PUBLIC ROOMS.

Mr. Mather has read to the Society of Arts, a paper "On the Ventilation of Schools, Churches, Public Rooms, &c." The author stated, that the application with which he had been honoured from the committee of the Union Schools at South Shields for suggestions for Ventilating their Schools, had afforded him an opportunity of doing so. The first room is a school for boys, and is on the ground floor; its length is sixty feet, breadth thirty feet, and height thirteen feet; and contains 23,400 cubic feet. The second room, for girls, is on the upper story, and is forty-five feet long, thirty feet broad, and thirteen feet high; and contains 17,550 cubic feet. In the first room there are 180 boys, each breathing not less than 1,200 times an hour, and requiring more than

142,000 cubic inches of atmospheric air per day of twenty-four hours, which, for 180 boys, will be 25,560,000, or for the five hours they are confined in the school-room, 5,325,000 cubic inches of atmospheric air, a seventh and three fifths of the entire air of the room, pouring into it in that time from their lungs about 391,500 cubic inches of carbonic acid gas,—taking it five per cent. of the atmosphere inhaled,—mingling with it, also, nearly 3,206,750 cubic inches of free azote, or nitrogen, which, with the carbonic acid gas, constitutes a large portion of the school atmosphere. I entered these school-rooms, (observes the author), towards the conclusion of school hours, and found the air vitiated to a serious extent,—emanations from the lungs and skin being very perceptible and sickly.

In order to prevent the injurious effects resulting from such an atmosphere, it is necessary that the whole air of the room should be changed at least every half hour, so that all noxious gas may be removed. For this purpose, he proposed that an aperture, not less than 12 inches by 24 inches, should be made through the wall on the west side of the room (the most open and unobstructed), six feet from the floor, equidistant from the end walls. This would be sufficient to displace the entire contents of the room every half hour, passing in at the rate of six feet per second. This column of air he proposed should be carried directly across the room by means of a wooden tube twelve inches by sixteen inches, like a beam, and a second tube, ten inches by ten inches from the same aperture, should rise perpendicularly against the west wall to the ceiling, cross it at right angles, and then descend the east wall till it meets the horizontal beam at its extremity. From the centre on the floor, a tube is to rise as a pillar supporting the horizontal beam. These tubes are each to have about five hundred holes drilled in them for the purpose of spreading the air in all directions. The author then proceeded to suggest various plans for the Ventilation of Churches and Dwelling-houses of all descriptions, and also of confined courts, lanes, and streets.—*The Builder*, No. 208.

NOXIOUS VAPOURS FROM SEWERS.

THE Society of Arts have awarded premiums to several plans to prevent the emission of Noxious Vapours from Sewers. The following is a description of two of them:—

Mr. J. Walker's Sewer-trap.—It is proposed that a tank or pocket in cement should be built, to receive the water through the gratings from the streets, whereby the grosser particles will be collected instead of passing into the river. A cast-iron elbow is to be fixed on the side of the tank leading into the Sewer. The elbow is to dip three inches into the water, so as to form a water-joint to trap the vapours from the sewers, and to prevent the bursting of the drains. At every such trap an air-pipe is to be inserted, which may be continued under the paving, and terminated up the nearest lamp-post, building, or rain-water-pipe.

Mr. Chadley's Plan for preventing the Emission of Noxious Vapours from Sewers.—This plan consists of a cast-iron basin suspended under the body of the trap by means of chains, for the purpose

of holding water to prevent the passage of the gas from the interior of the Sewers. A partition is formed across the basin, and parting any ice or other body in it by lowering the basin, which can be done by passing an iron rod through the grating, and unhooking one of the chains: any dirt that it contains may thus be discharged.

LAWS OF SOUND WITH REFERENCE TO BUILDINGS.

Mr. Scott Russell, from papers read to the Institute of British Architects, has deduced the following suggestive maxims:—

"In a large room, nearly square, the best place to speak from is near one corner, with the voice directed diagonally to the opposite corner.

"In all rooms of common forms, the lowest pitch of voice that will reach across the room will be most audible.

"In all rooms of common forms, it is better to speak along the length of the room than across it; and a low roof will, ceteris paribus, convey the sound better than a high one. It is better generally to speak from pretty near a wall or pillar, than far away from it. It is desirable that the speaker should speak in the key-note of the room, and evenly, but not loud.

"It is desirable that a rectangular room, or suite of rooms, should have their proportions multiples of the simple numbers 1, 2, 3, and 5, otherwise it will be difficult to give the noise equally. It is desirable, also, that the speaker be either at a corner, or at some simple proportion of the length, one-third, one-quarter, one-fifth, one-eighth, from the side, or corner, of the room.

"In a room about to be built, equal seeing and hearing may be obtained by ranging the seats in the acoustic curve.

"All surfaces at right angles to the direction of the sound should be avoided as far as possible; and angles of less than forty-five degrees with it substituted. If surfaces must be at right angles to the sound, they should be as distant as possible.

"In a very large building, escape of the sound, even from the building, should be, if possible, provided by transversal wings.

"In every case the separation of the wall-surface into small receptacles, like the private boxes of a theatre, the recesses of a library, or the side chapels of a Gothic cathedral, is favourable to distinct hearing.

"It is the belief of the writer, that a room formed on these principles might contain twelve to twenty thousand persons, all hearing perfectly a single human voice."

NEW BRIDGE AT PARIS.

A new "Pont aux Doubles" is now in course of erection on the site of the old one of the above name, consisting of a single arch, of which the following are the dimensions:—

	Metres.
Span	31·0
Versed sine	3·10
Thickness of voussoir—	
At key	1·30
At spring	3
Width of abutments	16

Small rough pieces of millstone, worked in promiscuously with Vassy cement, from the concrete blocks of which the bridge is built.

The bridge is alike remarkable for the novelty and boldness of its design. The engineer is M. de la Galisserie, and Messrs. Gariel and Garnier are the contractors.

In order to prove the plan, experiments were made last year, at Vassy, on a model arch of the same section as the "Pont aux Doubles," by a commission nominated by the minister of public works, consisting of Messrs. Mondot, De la Gorce, De la Galisserie, and Bellegrand, the results of which were so highly satisfactory that it has been adopted for the new bridge.

To avoid any ruptures or fissures in the work, in consequence of the sinking of the centres, the arch was commenced at four places at the same time, and spaces between the voussoirs subsequently filled in. This plan has succeeded, and no crack is perceptible either at the crown or the spring. Amongst other advantages claimed for this system is the rapidity with which the work proceeded, seventy cubic metres being laid on in one day. Lightness, economy, and solidity, are also mentioned as recommendatory of the plan.—*Mechanics' Magazine*, No. 1269.

FALL OF THE MONSTER CHIMNEY AT WIGAN.

This stupendous shaft was commenced by Mr. Dodd nearly five years since, for his Chemical Works at Wigan, close to the lands of the Leeds and Liverpool Canal. Its progress since that time had been gradual during the summer months, but it was necessarily stayed for several months of each winter, when its part completion gave indications of its future greatness. Its completion was effected late in 1846, when it had reached the great height of upwards of 400 feet, or about 134 yards, and the event was duly celebrated. Shortly, however, after this was done, an indentation of one side near the top was observed, and which was watched daily, when, after a further lapse of time, a very apparent deviation from the perpendicular had taken place, and the base slightly parted from the side of the excavation. A further inclination being observed, the advice of Mr. Fairbairn, civil engineer, of Manchester, was obtained:* previously, we believe, he recommended a portion of the top being taken down, and the work was consequently commenced, and continued until the day of its fall; at this time about 28 yards had been taken off. For some time a further sinking of the base had been observed, greater fears were entertained for its safety, and a series of stays were being constructed to pass round it. But all the measures were without avail. It fell on

* It is stated, that the proprietors of Muspratt's Chemical Works at Newton, have expended within eight months, nearly £7000 upon condensing apparatus, to prevent the noxious effluvia from their works annoying the neighbourhood. The plan for condensation has been most successfully carried out, and this is proved by the fact, that the vapour which now rises from the orifice of the monster chimney entirely disappears at the distance of about a hundred and fifty yards. If there were any muriatic or sulphurous acid gas mixed with the aqueous particles, and coal smoke expelled from the works, it would be visible for two or three miles.

Thursday afternoon, January 24, 1847, across the canal, and extended for the length of a field beyond it.—*Manchester Courier.*

THE MENAI BRIDGE EXPERIMENTS.

THE following are some practical details of Experiments made to determine the ability of the bridge to withstand the effect of gusts of wind by its lateral strength.

The result of the experiments clearly proves that the lateral stiffness of the tube is sufficient to resist the strongest wind which can act upon it —that is to say, for a *constant blast*, for should the blasts recur at regular intervals, the vibrations would of course be increased. Taking the force of the wind at 50 lb. on the square foot, which greatly exceeds any recorded measure, the resistance offered by the Menai Bridge would be about 200 tons + 2 = 600 tons, which is not two-thirds of its own weight; so that if the Menai tube, or a similar tube, support its own weight, when laid on the side, the weight thus supported would exceed the pressure of the wind. Now, the model tube, which is in every respect a similar tube to the Menai, being one-sixth of the dimensions, weighs 6·2 tons, and when laid on the side deflects ·85 in. only. The greatest weight we loaded it with in this position was 26,781 lb. (12 tons) + half its own weight = 15 tons, with which the total deflection was $3\frac{5}{8}$ in. Under this weight the tube showed no signs of falling; but as we did not wish to injure the tube, no more weight was added. When in its natural position this tube deflected 3·2 in. with 60 tons, which after being left on for sixteen hours increased the deflection to 3·35 in. Since that time the tube has been loaded again with 60 tons, which have been left on for ten days, and the deflections at the end of that time only exceeded $\frac{3}{8}$ of an inch. The calculated breaking weight of this tube is about 80 tons. Subjoined are the areas of the different parts of the tube as it now stands:—Top = 24 square in. of metal throughout. Bottom 22·3 square in. of metal at centre. Bottom = 9·0 square in. of metal at ends. Two sides = 9·6 square in. of metal, same throughout, 75 ft. between supporters. Top, 1-10 in. thick. Sides, 1-12 in. thick. Bottom double, 5-16 in. thick at centre. Bottom single, $\frac{1}{4}$ in. thick at ends.—*Railway Chronicle.*

THE BRITANNIA TUBULAR RAILWAY BRIDGE.

THE descriptive details of this stupendous design will be found in the *Year-book of Facts*, 1847, p. 18.

A correspondent of the *Leeds Intelligencer*, anticipating time, has given a notice of the Bridge, as if it were finished. Speaking of the iron tubes, he says:—"They are made of plates of iron, of various thicknesses, rivetted together: the iron increases in thickness as we proceed towards the centre. The roofs of the tubes are formed of cells, and also the floors. Those cells are formed of iron-plates set on edge, the cells of the roof being within a fraction of one foot nine inches square; and those of the floor being one foot nine inches wide, and 2 feet 3 inches deep. The rails on which the trains run are laid on these cells of the floor. The flat bottom, the two upright sides, and the flat roof of each tube, are formed of plates,

the thinnest of which is a quarter of an inch, and the thickest twelve-sixteenths of an inch; but the number of them laid together, and the internal joinings, cannot be yet explained. The weight of each of the long tubes will be about 1,300 tons; the weight of the four short ones about 600 tons. In the whole there will be at least 7,600 tons of iron used. No contracting estimate of the expense of the ironwork has been made, as the work may cost more or less, according to circumstances. The masonry was contracted for by B. J. Nowell and Co., at £130,000, but, from alterations in the plans, it will cost (supposing no further alterations be made) £200,000. They expect to finish the masonry in August, 1848. It will contain one million and a half of cubic feet of stone. In May last, fifty vessels of sixty or seventy tons each were employed in conveying the stones to the works; the red sandstone, of which the inside courses are built, from Runcorn; the blue limestone, of which the outside courses are built, from the sea-shores of Anglesea. The quarries on the Anglesea shores opened for this work extended over twenty miles. In the whole there were 1,300 men employed, 600 of them at the bridge; the fortnightly wages of the latter amounted to £1,500. Upwards of 200,000 cubic feet of timber have been used for stages and scaffolding. A steam-engine was at work on each shore; and a third was being erected on the Britannia rock, in the centre of the strait, to hoist the stones, grind mortar, saw timber, and perform other heavy work. On each shore there was a limekiln,—the chips of the limestone falling from the irons of the hewers being burned into lime, and the chips of the red sandstone being ground to powder to make mortar with the lime."

IRON BEAMS AND GIRDERS.

We quote these important and interesting experiments from *The Builder:*—

Mr. Fielder, in conjunction with Messrs. Baker, of Stangate, has taken out a two-fold patent:—first, for the construction of girders entirely of wrought-iron; and, secondly, "of girders of wrought and cast-iron riveted together, by which means (says the inventor) their co-operation is secured in a manner which the systems heretofore adverted to have evidently failed to accomplish."

One that we saw consisted of top and bottom flanges (10 inches wide and 1 inch thick) of welded plates, and a rib 2 feet 8 inches high and 8-12ths of an inch thick, of three pieces, secured and riveted at the heading joints. The flanges were secured by inch rivets to the rib, by means of an angle-iron on each side, 5-8ths of an inch thick. This girder, with a bearing of 31 feet 4 inches, had been subjected, it was said, to a proof of 150 tons on the centre, without injury to the elasticity of the metal, the deflection being 1 inch. 180 tons were assumed to be the breaking weight, one-half of which, or 90 tons, the patentee considers might be taken as the *working* weight.

In respect of girders made of wrought and cast-iron together, the patentee states, that he riveted to the bottom flange of a girder which had been broken in the middle, a piece of wrought-iron 8 inches by 5-8ths of

an inch, and then proved it to 22¼ tons without injury to its elasticity. The bearing was 20 feet; the height of the broken girder was 1 foot 8 inches. Another piece of wrought-iron, 8 inches by 7-8ths of an inch, was then added in the centre only, about 3 feet long, and the girder was then proved to 52½ tons.

The next experiment was upon a cast-iron girder, the breaking weight of which, by Hodgkinson's rule, would be 20½ tons. "It was proved to 15 tons without loss of elasticity, and then as far as 18¾, where a permanent set of 1-16th inch took place, the total deflexion having been 7-16ths bare. Here it is supposed that the metal was in some degree injured. A wrought-iron bottom flange, 6 by ¾, which, by the patentee's rule, would be 14·1-5th tons working power, was then attached to it, and the compound girder thus created was proved to 30 tons, with the same deflexion as took place before the wrought-iron addition, with a load of 18¾ tons, but in this instance without injury to its elasticity."

Mr. Fairbairn, of Manchester, has also patented a method for the construction of hollow wrought-iron beams. The mode, according to the *Mining Journal*, is to form the beam of stout plate-iron, rivetted at the joints to strong T iron, and at the angles to L iron, to give additional strength, and prevent buckling and deflexion as much as possible. A transverse section represents three chambers, the two square ones at top being together rather wider than the upright one, and all bolted together in the most substantial manner. In his specification for these hollow beams, he describes them under different constructions, suitable for mills, factories, warehouses, dwelling-houses, bridges, &c.

We subjoin a few jottings on the subject of girders, from various sources:—From Captain Coddington's report on the bridges of the Trent Valley line, and from his description of those constructed with cast-iron girders, we learn, that fifteen of these do not exceed 30 feet opening; four others vary between 35 feet and 37 feet 6 inches; every girder was proved at the foundry—the proof always extending to half the calculated breaking weight. The deflexion on the largest of these girder bridges, with a tram of three of the heaviest engines coupled together, was half-an-inch. Iron girder bridges exist on every railway in the kingdom; and he considered that up to a span between 35 and 40 feet, a flat cast-iron girder, of strength calculated to the usual formula, affords security as a railway bridge. With respect to the compound girders, similar to those over the Dee at Chester, there are six bridges, with girders in three castings, bolted together at the flanges, clipped underneath, and strengthened by massive wrought-iron rods, forming an inverted truss. There are two over the Trent and Mersey Canal—span, 54 feet 3 inches; one over the turnpike-road, 57 feet; one over the Coventry Canal, 60 feet; one over the Oxford Canal, 44 feet; and one over the River Tame, 70 feet span. The latter bridge has had a double row of piles driven in the bed of the river under each of the joining flanges of the girders; these piles are connected at the heads by cup sills, extending under the girders, and the interval between them and the girders is made good with wedges —thus dividing each span into three spans, and covered by a girder calculated equal to three times the span: he has no doubt, therefore, of the

strength and efficiency of this bridge. The other five range between 50 and 60 feet; and assuming that these compound girders, including their tension rods, are only half more in strength than the calculated beam, they fully come up to the proportions hitherto considered safe by eminent engineers. In testing these girders, there was but a deflexion of $\frac{3}{4}$ of an inch on a span of 60 feet. He remarks,—"In the same manner that I consider experience to have proved the sufficiency of a simple girder up to 40 feet, I consider it has also proved the sufficiency of the compound girders up to 70 feet."

Mr. Gibbons, of Corbyn's Hall Iron-Works, has patented a new method of trussing cast-iron girders, in which the rigid trusses heretofore employed are abandoned, and elastic ones substituted. The *Mining Journal* attempts to describe it, by supposing a girder of considerable length, formed of three sections, bolted together, through flanges at the end of each, in the usual manner. Mr. Gibbons now introduces beneath the centre section a powerful spring, made exactly similar to the bearing springs of railway carriages, with the convex side abutting on the girder; and wrought-iron truss-rods are fastened to each end of this spring, and bolted up tight to flanges, cast at the extreme ends of the two outer sections of the girder. Where the girders are of considerable width, a number of springs may be used, ranged side by side; or smaller springs may be used, and placed two together, with their concave faces inwards, one under each joint of the sections of girder, and one in the centre, trussed up tight by suspension-rods.

FIRE-PROOF BUILDINGS.

A PAPER has been read to the Institution of Civil Engineers, by Mr. Fairbairn, of Manchester, "On the Defects in the Principle and Construction of Fire-proof Buildings." It commenced by insisting strongly on the dangerous consequences of making use of cast-iron beams, of large span, without intermediate supports, unless the dimensions of the beams were very large; and pointing out the treacherous nature of a crystalline metallic body—such as cast-iron—when applied to support heavy weights in the construction of buildings. After some further remarks on the importance of a thorough knowledge of the laws which govern the use and application of cast-iron as a material for building, under the various strains to which it might be subject, the author proceeded to investigate the circumstances connected with the fall of Messrs. Gray's cotton-mill at Manchester. This building was stated to about 40 feet long, and 31 feet 8 inches wide; and to consist of two stories in height, containing the boilers below and the machinery above—over which, instead of a roof, was a water cistern, covering the whole extent of the building. The first floor was composed of large iron beams of 31 feet 8 inches span without intermediate support; and on these beams brick arches were turned sustaining the whole weight of the upper part of the building. The author demonstrated that these large beams were totally inadequate to support the weight of the superincumbent mass: especially as the whole pressure was upon the centre of the beams, which were of a form ill calculated to bear the pressure. Added to this, the

wrought-iron trussing was so badly applied, that the breaking strain was arrived at before the truss-rods were brought into a state of tension. The consequence of this was, that one of the lower beams broke in the centre under a less weight than it had previously supported.

In the discussion which ensued, it was argued that if proper proportions of material had been observed, the accident ought not to have occurred. It appeared that the wrought-iron truss-rods had been so put on that they allowed more than the breaking strain of the cast-iron to be arrived at before they came into operation. The instances of the trussed beam bridges so extensively used by Mr. Stephenson and other engineers on railways, were quoted, to show that by a judicious employment of wrought-iron trusses upon cast-iron beams, large spans might be crossed with safety—and even in some cases, where, from unseen defects in the metal, a beam had fractured, the truss-rods had sufficed to support the structure, and enabled the traffic to be continued across the bridge until the repairs could be effected. In all cases a strength of not less than four to one should be employed; and for such uses as the iron beams of pumping engines—which were exposed to great vibration and sudden shocks from the sudden influx of steam below the piston, or the accidental breaking of a pump-rod—the proportions of seven or eight to one should be observed.—*Athenæum*, No. 1018.

STUPENDOUS IRON DOCK-GATES.

A PAPER has been read to the Institution of Civil Engineers, by Mr. Shears, descriptive of the Iron Dock-gates constructed by Messrs. Rennie, for the Russian government, and erected at Sevastopol, on the Black Sea. Sevastopol is very peculiarly situated amidst rocky ground, rising so abruptly from the shore, that there was not space for the buildings necessary for a dock-yard. On account of the depth of water close in shore, and other natural advantages, the Emperor determined to make it the site of an extensive establishment; and as there is not any rise of tide in the Black Sea, and as the construction of coffer-dams would have been very expensive and difficult in such a rocky position, it was decided to build three locks, each having a rise of 10 feet, and at this level of 30 feet above the sea to place a main dock with lateral docks, into which vessels of war could be introduced, and the gates being closed, the water could be discharged by subterranean conduits to the sea, and the vessel being left dry, could be examined and repaired even beneath the keel. A stream was conducted from a distance of twelve miles to supply the locks and to keep the docks full; this, however, has been found insufficient, and a pumping engine in aid has since been erected by Messrs. Maudslay and Field.

The original intention was to have made the Gates for the Docks of timber; but on account of the ravages of a worm, which it appears does not, as in the case of the *Teredo navalis*, or the *Terebranes*, confine itself to the salt water, it was resolved to make them with cast-iron frames covered with wrought-iron plates. There are nine pairs of Gates, whose openings vary from 64 feet in width and 34 feet 4 inches in height, for

ships of 120 guns, to 46 feet 7 inches in width, and 21 feet in height, for frigates.

The manipulation of such masses of metal as composed these Gates demanded peculiar machines; accordingly Messrs. Rennie fitted up a building expressly, with machines constructed by Mr. Whitworth, by which all the bearing surfaces could be planed, and the holes bored in the ribs and all the other parts, whether their surfaces were curved or plane. The planing was effected by tools which travelled over the surfaces backwards and forwards, cutting each way; the piece of metal being either held in blocks if the surface was plane, or turned on centres if the surface was curved. The drilling was performed by machines so fixed that the pieces could be brought beneath or against the drills in the required direction, and guided so as to insure perfect uniformity and accordance between them. Travelling cranes were so arranged as to take the largest pieces from the wharf and place them in the various machines, by the agency of a very few men, notwithstanding their formidable dimensions; the heelposts in some casts being upwards of 34 feet long. Each endless screw, for giving progressive motion to the cutting tools, was 45 feet long. Some idea may be formed of the manual labour avoided by the machines, when it is stated that the surface planed or turned in the nine parts of Gates equals 717,464 square inches; and in some cases a thickness of three-quarters of an inch was cut off. The surface in the drilled bolt-holes equals 120,000 square inches. The paper gave all the details of the construction of the Gates, and the machinery for making them, and was illustrated by a series of detailed drawings. An interesting discussion followed, chiefly on the peculiarity of the site selected for the Docks, and the supposed ravages of the worm in fresh water, as it was of unusual occurrence. It seemed to be the opinion, that temperature of climate influenced the ravages of these insects.—*Literary Gaz.* No. 1565.

BLEWITT'S IMPROVEMENTS IN MALLEABLE IRON.

Pig, or cast iron, is ordinarily prepared for being made malleable by melting with coke in refining-furnaces, and keeping it there in a state of fusion, exposed to a strong blast and to a great degree of heat.

The produce is afterwards run out into moulds, and becomes what is termed refined iron, metal, or plate. It is then submitted, either alone or in combination with pig or other cast iron, to the "puddling" process, and is thus brought into a partial state of malleability.

Mr. Blewitt states, that he has discovered that a better quality of refined metal can be produced with less waste of iron, and with less fuel, by using air-furnaces instead of refining-furnaces. The mode he adopts (and which he has patented) is this:—he heats an air-furnace in the usual way, and for each charge puts in about four tons of pig or cast iron, of the qualities which he deems most suitable for the production of the required quality of malleable iron. After the charge is properly melted and mixed together, it is run into moulds for the after purposes of moulding, which is conducted in the ordinary way.

The fuel which the patentee prefers to employ for the purposes of his invention is a white-ash, semi-bituminous coal, although he has used one

or two hundred weight of charcoal to each charge of iron with advantage. —*Mechanics' Magazine*, No. 1269.

IMMENSE WIRE ROPE.

A ROPE, nearly three miles long, has been manufactured near Gateshead, by Newall and Co. It is 4,660 yards in length, and is, we believe, the stoutest rope of the kind that was ever made. It weighs twenty tons five hundred-weights, and will cost the purchasers upwards of £1,134. It is intended for the incline on the Edinburgh and Glasgow Railway, near the latter city. A rope of hemp, of equal strength, would weigh thirty-three and a half tons, and cost about £300 more. It would also entail greater expense while in operation (owing to its greater weight) and would sooner wear out.

GREAT BELL FOR MONTREAL CATHEDRAL.

ON Feb. 20, the casting of this huge Bell was completed by Messrs. Mears, of Whitechapel, the founders, *inter alia*, of the great bells of Lincoln and York. The Montreal bell is rated to be the largest in the British Empire. The following details are from No. 255 of the *Illustrated London News*, wherein the colossal novelty is engraved.

It was necessary for the purpose to fuse about twenty-five tons of metal, which, at the proper heat, was let loose from the furnaces, and thence safely lodged in the mould in twelve minutes from the time of "*tapping*." After a few days being allowed for the *cooling* of the casting, it was raised from the pit, and the mould detached from the metal. When freed from its earthy incumbrance, the soundness of the casting, and the quality of the tone, proved perfectly satisfactory to the founders.

The weight of the bell may be taken at thirteen and a half tons. Its dimensions are as follows:—

Diameter at mouth	8 ft.	7 inches.
Height to shoulder	5	11
Diameter at shoulder	4	8

The thickest part, or sound bow, is 8 inches.

The tone of the bell, which is grand, deep, round, and sonorous, is upon the key of F below the line—bass clef of the pianoforte scale.

The inscription is in Roman capitals:—

NEGOTIAMINI. DUM VENIO. OMNES SPIRITUS. LAUDET
DOMINUM: ANNO DOMINI 1847 FUNDATÆ. MARIANAPOLIS 202°
PII. P. P. XI. PONTIFICIATUS 1° REGNI VICTORIÆ. BRITANNIUM 10°
EX PIISSIMO. MERCATORUM
AGRICOLARUM. ARTIFICUMQUE
MARIANOPOLITANENSIUM: DONO

And upon the lip:—

CAROLUS. ET. GEORGIUS MEARS. LONDINI. FECERUNT.

The bell is ornamented, and has cast upon it the effigies of the Virgin and St. John the Baptist; besides a Medallion, illustrative of Agriculture, Manufactures, and Commerce.

It may be interesting to state the comparative sizes and weights of the great bell for Montreal, with some other large bells:—

	Diameter. ft.	in.	Weight. ton.	cwt.		Diameter. ft.	in.	Weight. ton.	cwt.
Montreal ..	8	7 ..	13½	0	Oxford ..	7	2 ..	8	0
Paris ..	8	6½ ..	13	0	Lincoln ..	6	10 ..	5	8
York ..	8	2 ..	11	0	Ghent ..	6	10 ..	5	0
Malines ..	7	9 ..	9	0	St. Paul's	6	9 ..	5	0
Cologne ..	7	6 ..	8½	0					

WORKING METALS.

Mr. Carpmael has read to the Royal Institution, a paper "on the Raising and Shaping Metal by Stamping and Pressure." Mr. Carpmael's purpose was to show how objects of extreme perfection of workmanship and of great use in daily life, are produced by simple manipulation. Having adverted to the old process of stamping sheet metal, and remarked that this process grenerally required that the article stamped should have a flange or rim, and that the process was inapplicable to any ornamental work which required undercutting in the sculptured part, Mr. Carpmael proceeded to describe the improvement lately introduced by what is technically termed *spinning* (i. e. burnishing to form.) This operation is performed by fixing the object in a lathe and pressing its surface with a blunt tool. Mr. Carpmael explained how, by means of a divided mandril, undercut forms could be obtained. He then pointed out that this burnishing to form could be alternated with *casting;* and that the flange was rendered unnecessary in the casting process—the metal being driven through a conical mould, much on the principle on which pipes, &c. are drawn: the difference being, that in the process which Mr. Carpmael was describing, the object was forced through the gradually-contracting aperture, by the blow of a heavy weight falling on its lower surface. The effect of these combined operations was not only to produce ornamental articles, but also others of utility, and at a low price. Of the latter, Mr. Carpmael presented an example in a tea-pot, made of tinned iron-plate by the joint process of *casting and burnishing to form.* This article, which he affirmed to be of the best fabric, is sold (wholesale) for 1s. 8d. In conclusion, Mr. Carpmael exhibited the machines by which tin is shaped into boxes and bottles for holding colours, perfumes, &c., by squeezing a small ingot of this ductile metal by a powerful pressure.

BERLIN CASTINGS.

Ehrenberg states that the peculiar fineness of these Castings is owing to the iron and sand employed being of a peculiar quality, and only to be met with in the neighbourhood of Berlin. The former is made from bog-ore, and the latter is a sort of tripoli, containing a considerable admixture of iron.—*Mechanics' Magazine*, No. 1,255.

JEWELLERS' GOLD.

Mr. Waterson, in his useful manual, entitled "A Familiar Explanation of the Art of Assaying Gold and Silver, &c." states, "It has recently been found that gold of the quality of twelve carats or less, if alloyed with zinc instead of the proper quantity of silver, presents a colour very nearly equal to that of a metal at least two and a half or three carats higher, or of 8s. or 10s. an ounce more value; and the consequenee has been, that a

large quanity of jewellery has been made of gold alloyed in this manner: and the same has been purchased by some shopkeepers, very much to their own loss, as well as that of the public; inasmuch as a galvanic action is produced, after a time, upon gold so alloyed, by means of which the metal is split into separate pieces, and the article rendered perfectly useless. Gold chains, pencil-cases, thimbles, and lockets, are the articles of which the public and the shop-keepers will do well to take heed; as those have, among some other things, been lately so constructed."

METALLIC ORNAMENTS.

M. PIAGET has exhibited to the Institution of Civil Engineers, specimens of his improvements in producing Ornamented Metal Surfaces, formed by the deposition of metals during the electrotype process, which is conducted in a peculiar manner with mixtures adapted to the effect desired to be attained. The form also of the bath is peculiar; and when the plate is taken out of it and off the model, it exhibits a burnished polish or a dead appearance according to the preparation used. The metal thus produced is stated to be of a much better description than metals which have not undergone such process; as it is more flexible, and is capable of withstanding the action of heat without destroying the form or the copper, and the surface will not tarnish when exposed to the air. Portions of any pattern can also be silvered by a similar process; and the general expense is about one-third of that of engraving or chasing, while the closest or most minute patterns can be equally well produced.

MUNTZ'S PATENT SHEATHING METAL.

THE patentee states that the object of his present invention is an Improvement in the Manufacture of his Sheathing Metal, for which letters patent were granted to him on October 22, 1832, and which consisted in making a sheathing metal for the bottom of ships or vessels, of an alloy of sixty parts of copper and about forty parts of zink, whereby the cost of the material has been very greatly diminished. In this alloy the copper was, to a great extent, preserved; although sufficient oxydation was obtained to keep the bottom of ships or vessels, so sheathed, clean; and separate action on the zink prevented.

Now, by the present invention, Mr. Muntz proposes to diminish the proportion of copper hitherto employed in the alloy, and thereby the cost of the article. For this purpose, he makes the alloy according to the following new proportions:—Fifty-six parts of copper; forty and three-quarters parts of zink; and three and one-quarter parts of lead..

The alloy is then cast into ingots, rolled into sheets, by preference, at red heat, and annealed; and, if desirable, may be polished in the ordinary manner, by using nitric and sulphuric acid, properly diluted. The patentee remarks, that the lead acts a very important part in this alloy, as, without it, the fifty-six parts of copper, and forty and three-quarters parts of zink, would not oxydize sufficiently to keep the bottoms of the ships or vessels clean—nor would separate action on the zink be prevented; and further, that, instead of lead, any other suitable metal or metals may be used.—*Mechanics' Magazine*, No. 1236.

IMPROVEMENTS IN CASTING CYLINDRICAL PIPES.

Mr. Stuart, of Montrose, has patented a new mode of casting Iron Water or Gas Pipes, by which a superior material is produced, at a less cost than by the usual method. The mould consists of a perpendicular cylindrical iron box, of the required size, with a shaft in the centre, longer than the mould, and communicating with machinery above, by which it is kept revolving, and, as it revolves, it gradually rises. At the bottom of this shaft is an instrument, which may be termed a "presser," or "rammer," consisting of an iron block, having inclined tabular faces, of such smaller diameter than the box, as to leave the sand of the required thickness for the mould. On feeding the sand at the top of the box, it is distributed towards the sides, and the shaft and rammer, gradually revolving and rising, press it with great force against the sides of the box, leaving the mould finished and perfectly cylindrical on its arriving at the top, ready for the insertion of the core. The amount of pressure against the sand is regulated by means of a counterpoise weight.

The following are the advantages claimed by the patentee:—"1. A perfectly straight cylindrical pipe, of uniform thickness; 2. No parting or joint of any kind; 3. Dressed at one-half the ordinary cost; 4. Less sand used than in any other way, and, of course, easier dried, if required; 5. The castings and sand easier removed from the boxes than in the ordinary way; 6. The flasks, or boxes, better calculated to resist the pressure of the metal than any now in use; 7. This method is the best for casting pipes perpendicularly that has hitherto been employed; 8. The greatest recommendation of all is, the simplicity of the apparatus, which requires the attendance of a boy only, who with my machine, as at present working, turns out easily six pipes, six inches bore, per hour.—*The Builder*, No. 247.

IMPROVED METHOD OF TEMPERING TOOLS.

Mr. Newton, of Chancery Lane, has patented an apparatus for Hardening and Tempering Edge Tools. For heating axes or other similar articles is a furnace constructed in the form of a verticle cylinder, the exterior made of sheet-iron lined with fire-brick 4 feet 8 inches in diameter, or of such outside diameter, as to give it at inside one of 4 feet and 3 feet high. In the interior of this cylinder several fire-chambers are formed, usually four; the inner wall of each fire-chamber is 18 inches long, 4 inches from front to back, and about 4 inches in depth, forming, in the whole, a circle of 3 feet 4 inches diameter; under each there are grate bars, and air is supplied through a pipe, connected with a blowing apparatus. A circular table of cast-iron, 3 feet 4 inches diameter, is made to revolve slowly on a level with the upper part of the same chambers; this table is sustained on a central shaft, which passes down through the furnace, and has its bearing in a step below it; a pulley keyed on to it serves to communicate rotary motion to the table. When the axes or other articles are to be heated, they are placed upon the table with their bits or steeled parts projecting so far over its edge as to bring them directly over the centre of the fire, and the table is kept slowly revolving during the whole time of heating: when duly heated they are ready for

the process of hardening. The hardening bath consists of a circular vat of salt and water; within the tub or vat, a little above the surface of the liquid, is a wheel mounted horizontally, with a number of hooks around the periphery, upon which the axes or other articles are suspended; the height of the hooks from the surface of the liquid is such as to allow the steeled part only to be immersed; as soon as the hardening is effected, the articles are removed from the hooks, and cooled by dipping in cold water. With the best cast-steel, a temperature of 510° Fahr. has been found to produce a good result in hardening within about forty-five minutes.—*Mining Journal.*

METAL GILDING.

THE relative merits and peculiarities of the three modes, namely, by Amalgam, by Galvanic Action, and by mere Immersion, have been rather curiously brought to light by the simple test of Nitric Acid applied by M. Barral. The article, when attacked by dilute acid, yields a pellicle, or scale of gold pure on the inner surface, if electro-gilt, or by immersion; but if by amalgamation, of a reddish brown colour, shewing that the coating has been united with the substance of the article by a double amalgamation, so that the old process is a more solid one than the new; but then, the pellicle of the old process is full of minute though distinct holes, through which the mercury had been driven off, while the pellicle of the new is quite opaque and solid; so that the latter is much better adapted for vessels in domestic use, liable to the action of acids; while the former will probably stand mechanical tear and wear with much more hardiness and endurance.

CORROSION OF LEADEN PIPES AND CISTERNS.

THE endeavour to protect Lead from the action of Water, by placing it in contact with Zinc—hitherto generally understood to answer the object—according to a statement by Professor Solly, at the Royal Institution, has signally failed. So much does the present result of experiment vary from that previously made, that it is said the corrosion is greatly increased by the presence of zinc, and the water thus rendered additionally poisonous. The Professor also referred to an attempt to render lead insoluble by alloying it with $\frac{1}{200}$ of its weight of arsenic. Mr. Solly also shewed, that unless water contain from $\frac{1}{8000}$ to $\frac{1}{4000}$ of its weight of earthy salts, such as sulphate of lime, it ought never to be taken internally, if kept in leaden cisterns; these earthy salts protecting the lead from the action of the water.

MANUFACTURE OF INDIA RUBBER IN BRAZIL.

MR. EDWARDS, in his *Voyage up the Amazon*, relates, that on one occasion he saw a labourer returning from the forest bringing in nearly two gallons of milk, which he had been engaged since daylight in collecting from 120 trees that had been tapped upon the previous morning. This quantity of milk, he said, would suffice for ten pairs of shoes, and when he himself attended to the trees, he could collect the same every morning for several months; but his girls could only collect from 70

trees. In making the shoes, two girls are the *artistes*, in a little thatched hut, with no opening but the door. From an inverted water jar, the bottom of which had been broken out for the purpose, issued a column of dense white smoke, from the burning of a species of palm nut, and so filled the hut that we could scarcely see the inmates. The lasts used were made of wood imported from the United States, and were smeared with clay to prevent adhesion. In the leg of each was a long stick, serving as a handle. The last was dipped into the milk, and immediately held over the smoke, which, without much discolouring, dried the surface at once. It was then redipped, and the process was repeated a dozen times, until the shoe was of sufficient thickness, care being taken to give a greater number of coatings to the bottom. The whole operation, from the smearing of the last to placing the finished shoe in the sun, required less than five minutes. The shoe was now of a slightly more yellowish hue than the liquid milk, but in the course of a few hours it became of a reddish brown. After an exposure of twenty-four hours, it is figured, as we see upon the imported shoes. This is done by the girls, with small sticks of hard-wood, or the needle-like spines of some of the palms. Stamping has been tried, but without success. The shoe is now cut from the last, and is ready for sale, bringing a price of from ten to twelve vintens or cents per pair. It is a long time before they assume the black hue. Brought to the city, they are assorted, the best being laid aside for exportation as shoes, the others as waste rubbers. The proper designation for this latter, in which are included bottle, sheets, and any other form excepting selected shoes, is *boracha*, and this is shipped in bulk. By far the greater part of the rubber exported from Para goes to the United States, the European consumption being comparatively very small.

VULCANIZED RAILWAY INDIA RUBBER BUFFERS.

Mr W. C. Fuller has described to the Society of Arts this invention. It consists in substituting a series of rings of india rubber, separated by iron plates for the ordinary spiral spring. The buffer-rod passes through the centre of the rings, and is protected from being bound by the india rubber when compressed by means of a conical flange affixed to the iron plates The advantages which this invention appears to possess over the ordinary springs are—reduction in weight, less liability to get out of order, and greater facility of increasing or decreasing the power of the spring. Supposing the length of the india rubber employed to be three feet, Mr. Fuller stated that the length of stroke required for the buffer to be from ten to thirteen inches; that the ordinary strength of the present springs is from three to three and a half tons; that is, three tons reduce the circular spring to a flat, while the india rubber is capable of resisting from five to ten tons.—*Abridged from the Athenæum*, No. 1018.

VULCANIZATION OF INDIA RUBBER.

Mr. Brockedon has read to the Royal Institution, a paper "On the Preparation of India Rubber by Vulcanization and Conversion," his object being, to describe—1, A mode of treating india rubber by which new properties are imparted to this substance; 2, The new uses in the arts to

which these acquired properties now render india rubber applicable. *Vulcanization* and *conversion* denote that combination of india rubber with sulphur from which the new properties about to be described result. The process of conversion consists in submitting india rubber to the action of bisulphuret of carbon mixed with chloride of sulphur. The caoutchouc cannot, however, be penetrated by this process to any depth, and therefore it is inapplicable when the mass to be acted on is thick. The process of *vulcanization*, which seems to be more applicable, is the result of many experiments made by Mr. Hancock, who found that caoutchouc, when immersed in a bath of fused sulphur heated to various temperatures, by absorbing the sulphur, assumed a carbonized appearance, and lastly acquired the consistency of horn. It was in the course of these changes that it attained the state of vulcanization which Mr. Brockedon afterwards described. The same vulcanized condition can, however, be produced either by kneading the india rubber with sulphur, and then exposing it to a temperature of 190°, or by dissolving the india rubber in any known solvent, as turpentine, previously charged with sulphur.

Having thus explained the processes, Mr. Brockedon described the effect which they produced on the caoutchouc:—1, The india rubber thus treated remains elastic at all temperatures: in its ordinary state it is quite rigid at a temperature of 40°. 2, Vulcanized caoutchouc is not affected by any known solvents, as bisulphuret of carbon, naphtha, or turpentine. 3, It is not affected by heat short of the vulcanizing point. 4, It acquires extraordinary powers of resisting compression: thus, a cannon-ball was broken to pieces by being driven through a mass of vulcanized caoutchouc, the caoutchouc itself exhibiting no other trace of its passage than a scarcely perceptible rent. The applications of this substance appear to be almost infinite. Our readers are familiar with the usefulness of the "elastic bands," but they may not be aware that the same fabric, adjusted in size and strength to the purpose required, furnishes springs for locks and for the racks of window blinds. It is also capable of being moulded into the most intricate ornaments, its characteristic elasticity removing all embarrassment in relieving the undercut parts. It furnishes impervious bottles for volatile substances, like ether, as well as an excellent inkstand. It is adapted to protect from corrosion wires subjected to the action of the sea, as in the case of the wires required for the projected electric communication between England and France. For the same reason, air-tubes of vulcanized rubber are better suited for life-boats than those formerly made of canvas, which are liable to be destroyed by the action of the water. A similar tube has been used with success as a substitute for an iron band as the tire of a carriage-wheel, and it is stated that a vehicle so arranged runs much easier than on the present plan. But, perhaps, the most important application is in its use in railroads and railroad carriages. In the former, it is laid between the rail and the sleeper, and thus prevents the rails from indicating any traces of pressure; and the springs connected with the buffers of the latter, when formed of vulcanized caoutchouc, can neither be broken, nor can their elasticity be surmounted by any degree of concussive violence. In conclusion, Mr. Brockedon exhibited objects illustrative of the great physical change induced on caoutchouc by vulcani-

zation. He showed a screw, with its recipient, both made of this substance, as well as a form of letterpress (like a stereotyped page) for printing. He also noticed its usefulness in making epithons for surgical purposes, gloves and boots for gouty persons, &c.—*Athenæum*, No. 1018.

INDIA RUBBER INK-ROLLERS.

An experienced printer of Washington has discovered a mode of making printers' Ink-rollers of the prepared and improved india rubber: they are stated to be more permanently elastic, and will last at least ten times as long, as rollers made in the usual way, and of the ordinary material.

MARINE GLUE.

The Lords Commissioners of the Admiralty issued instructions, in January 1843, to the master shipwright of Chatham Dockyard, to have the mainmast of the *Curacao*, 24, then fitting at that port, joined with Marine Glue, to test its capabilities for that purpose. The mast was accordingly made of several pieces of timber joined together, under the immediate superintendence of Mr. Jeffery, and when completed measured 28 inches in diameter and 66 feet in length, and, when put up with the topmast, 90 feet 10 inches. The *Curaçoa* was soon after commissioned by Captain Sir Thomas Pasley, Bart., and proceeded to the South American station, and after serving the usual period was ordered home, and recently paid off at Sheerness. The vessel having been dismasted, their Lordships ordered that the mast should be opened, as is usual after four years' service, to ascertain its present condition. The master shipwright, Mr. Watts, at Sheerness Dockyard, in compliance with their Lordships' order, set eight men to work with sledge hammers and wedges to separate the timbers, but their whole united efforts at one time failed in separating the joints, and only split the solid timber into large pieces. Mr. Watts then considered it best to have the mast cut into sections about eight feet long, for one piece to be transmitted to each dockyard, to satisfy the master shipwrights that they were correct in their judgment when they assembled in committee, and reported to the Government that this invention was "one of the most valuable discoveries of modern days for ship-building purposes." On the mast being cut into pieces, it presented a most perfect and sound interior throughout, and the marine glue was as perfectly adhesive as a fortnight after its application. The foremast, which was joined in the upper part in the usual manner adopted at the dockyards, was found to be very rotten, the parts where the wet had entered and been retained, yielding to the pressure of the hand like a piece of sponge, and in other places, where dry, crumbled into powder on being pressed. The original cost of a mast of the same dimensions as the mainmast of the *Curacoa* is upwards of £250; and now that it has been proved by upwards of four years' trial, that "made" masts joined with marine glue are equally serviceable after that period as when first made, the saving to the country would be very great were all the future made mainmasts for vessels and ships in the Royal Navy to be joined with that substance.—*Mechanics' Magazine*, No. 1267. See also details of previous Experiments in Year-book of Facts, 1843, 1844, and 1846.

KAMPTULICON SHEATHING FOR IRON SHIPS OF WAR.

Mr. Nixon, in a pamphlet which he has written on the subject, admits that Iron Vessels are much more exposed to danger from shot than those of wood. His remedy is the adoption of a lining or sheathing of the cork and caoutchouc composition, known by the name of *Kamptulicon*, patented by Lieutenant Walter, R.M.* The advantages claimed for this composition are,—That in consequence of its elasticity it will immediately collapse after the passage of a shot, so as to prevent the entrance of water, thus *obviating the necessity for plugs;* — That it will deaden the concussion caused by the striking of shot, or in firing a vessel's own guns, thus *protecting the rivet-heads;*—That, from its buoyancy, it will keep a vessel afloat if riddled with shot, or after striking upon rocks, and will enable her to carry *a large supply of coals with a smaller draught of water;*—And that it will prevent the *loss of life caused by splinters,* by their retention in the material.

Mr. Nixon bears the following personal testimony to the value of the *kamptulicon*:—"To the truth of most of these assertions I can bear ample testimony, having witnessed the experiment at Woolwich on the 4th of September last, the object of which was principally to test the practicability of its adhesion to the iron *without the use of bolt or bar of any kind*, four previous experiments having, it was stated, given great satisfaction in other respects. A target of iron, six feet square, to which the *kamptulicon* lining was attached by means of a solution prepared for the purpose, was erected at a distance of forty yards from a 32-pounder. Four shots were fired, with the iron surface presented, with very curious effect, two of which deserve especial notice, viz. the third, which, fired with a reduced charge to represent a long range, lodged in the material; and the fourth, which, with still further reduced charge, fell, without doing injury, at the base of the target. It was then turned round, with the *kamptulicon* lining towards the gun, at which four shots were also fired. The first two passed through with nearly the same effect, opening out the iron to a considerable extent, but the lining closed up immediately, so as scarcely to admit the insertion of a small cane at either end, the centre being quite close. The fourth shot, fired with a very reduced charge, *rebounded* about *fifteen yards* in a direct line; thus proving that a shot at a *long range* would not even *enter* a vessel so *lined*. It may also be presumed, from the wonderful resistance of the material, and its repellant power, that nothing under a *full charge would fire a shot through the two sides*. As to its adhesive nature, it need only be said, that it occupied a dozen strong men, armed with handspikes and crowbars, a considerable time to detach it from the iron after all this battering. In small portions cut from the different targets may be seen large pieces of iron imbedded, which might cause frightful wounds, and even death, if scattered among a crew."—*Mechanics' Magazine*, No. 1230.

NEW OIL.

A communication, from Mr. W. Taylor, has been read to the Royal

* Lieut. Walter's Kamptulicon Life-boat is described in the Year-book of Facts, 1845, p. 52.

Institution, "On a new Oil Plant called the *Gold of Pleasure* or *Camelina sativa*, and its importance to agriculturists and manufacturers generally, with remarks on the opportunity now afforded of introducing its cultivation into Ireland." Samples of the seed and oil were exhibited. "I have," observes Mr. Taylor, "paid great attention for the last twenty years to the cultivation of oliferous plants, the result of which has been the discovery of the Gold Pleasure or *Camelina sativa*. The plant is an annual belonging to the natural order *Crucifera*, and grows to the height of two or three feet; it is a native of the most northern parts of Siberia. The first supply of seed was received from Professor Fischer, of the Royal Agricultural Society of St. Petersburgh: the soils best adapted to its cultivation are those of a light nature, but it does not fail to produce a crop on land of the most inferior description; it has been found on barren sandy soils where no other vegetable would grow. The time for sowing the seed is early in the spring months; the quantity of seed required per acre is ten pounds; it should be drilled in rows about nine inches apart, and may be cultivated after any corn crops, and is a non-exhauster of the ground. Professor Van Ost, an eminent experimental chemist of Belgium, says: 'If farmers did but know the value of this plant they would all grow it.' A fine oil is produced from the seeds, fit for burning in lamps; it can also be used in the manufacture of woollen goods, soap, &c., and can be sold at a cheap rate. The oil-cake made from this seed has also been found highly nutritious and useful in fattening oxen and sheep, as it contains a great portion of mucilage, albumen, gluten, and other matter, which when combined is found to be very beneficial in developing fat and lean." Mr. Taylor concludes his paper by referring to the present distressed state of Ireland, and the importance of endeavouring to introduce into that country the cultivation of so valuable a plant; expressing, also, his willingness to find seed, provided he might be allowed to purchase the crop, which he states is worth eight or ten pounds per acre without the straw.

ACHROMATIC LAMP GLASSES.

A VERY simple contrivance, but one which is of universal importance, and affects all who value their eye-sight, has been recently patented. It consists in substituting for the glass chimneys at present in use, for gas lights, and oil and other lamps, glass chimneys made of blue or rather gray glass, which are either ground or polished, as the case may be. The effect of this simple introduction of a coloured medium through which the light of the flame passes, is to get rid of the red or yellow glare of the artificial light, and to produce a pure white light, similar or closely approaching day-light. The relief given to the eyes by this means is at once experienced, and the aid afforded to artists, and painters more particularly, is obvious. The expense of this improvement is not more than that of the present mode.

HARTLEPOOL (GAS) LIGHTHOUSE.

A NEW Lighthouse has been constructed upon the eastern extremity of the peninsula, jutting out into the sea, a few miles from the Tees' mouth.

The system adopted in the lighting arrangements, is, to a certain extent, both catoptric and dioptric, and the illuminative medium is gas. The optical apparatus embraces three-fourths of the circumference of the circle which encloses the light, and the whole of the rays emanating from that part of the light opposed to the optical arrangement are reflected or refracted (as the case may be), so that they are projected from the Light-house in such a direction as to be visible from the surface of the ocean.

The application of gas to the illumination of lighthouses has always been regarded as an important and desirable step. Mr. Stevenson, in evidence before a Committee of the House of Commons, remarked that "the great desideratum with respect to the lighting of lighthouses, was a gas-burner of large size, and that it was in that direction that improvement was to be sought." Hitherto, however, no gas-burner has been constructed capable of furnishing the necessary amount of light, combined with the steadiness, intensity, and solidity of flame requisite to render its application advantageous as a substitute for the oil lamp.

As a means of illumination, gas possesses numerous advantages over oil; and under no circumstances are those advantages more strongly displayed than in the case of a lighthouse, where simplicity in the machinery, facility of management, and certainty of effect, are objects of the greatest importance.

The gas-burner employed in the present instance appears to supply that which has so long been wanting; its chief peculiarity lying in the method employed to supply the air necessary to the perfect combustion of the gas. This supply is not only regulated with great exactness, but all the parts by which the air passes are placed on such angles that the impinging air is reflected and forced directly into the flame at the precise point in which it will conduce most powerfully to support the combustion. At the same time, the requisite quantity only is admitted; and therefore the flame is perfectly steady, and not, as it is technically termed, distressed and driven into spires by too powerful and rapid a current of air. The inverted cone placed in the centre is hollow: and the air which is admitted by the tube which supports it, issues into the flame by a row of holes placed round the periphery of its base. By these contrivances, the burner is made to produce a rich opaque mass of flame, affording a powerful and steady light; and, when placed in the centre of the optical arrangement of lenses, lenticular zones, and mirrors, an immense amount of intense light is spread over the horizon.

The capability of gas to produce a light sufficiently powerful, has been satisfactorily proved; for, in some cases, it has been distinctly seen on board ships at least eighteen miles distant from the coast; the gas, on this occasion, was used in its ordinary condition; but, it has been proposed to naphthalise the gas, and, in that case, the power of the light will be increased by at least twenty per cent.

The Hartlepool Lighthouse was built and the optical apparatus planned by Mr. Stephen Robinson, Civil Engineer. The burner is that patented by Messrs McNiell and Co., 60, St. Martin's-lane, who fitted up those employed in the Lighthouse, and all the arrangements for lighting with gas.—*Abridged from the Illustrated London News*, No. 288.

PRAIRIE CARS.

A STRIKING improvement is the Prairie Car. This invention is not presented with the noisy pretensions that frequently characterize the advent of new discoveries, but seems to claim for itself no more than experiments justify us in believing it can accomplish. It is not intended to rival the railroad system, where that can be successfully established and sustained; but it is intended for prairies and other level and unbroken grounds, where no road is necessary to be built for it, and where the amount of travel and transportation will not justify the construction of railroads. Within these limits it promises great usefulness, as there are extensive regions in the west which present an appropriate field for its successful operations.

The prairie car consists of a frame of proper strength and dimensions to sustain the steam engine or other superincumbent weight. This frame, instead of resting upon ordinary wheels, is supported by hollow cylinders of a convenient diameter, and very wide tread. These cylinders are placed upon axles, and constitute the driving wheels. The cylinders are made hollow, for lightness, and close, to prevent the entrance of mud or other matter, and the tread is very broad, to prevent sinking into soft earth, &c. Two smaller wheels of similar construction are placed upon axles in a separate frame, at one end of the car, to guide it. This frame turns upon a pivot, by which it is connected with the main frame, and is operated by such means as are convenient for steering. The foregoing are the prominent features of the car, or locomotive. The propelling power is applied to the driving wheels in any convenient way. There is much originality in the idea of traversing the prairies by steam cars, upon their natural and unbroken surfaces, and much merit in adapting the cars to the nature of this novel undertaking.—*Report of the American Commissioners of Patents; Mechanics' Magazine*, No. 1225.

THE PATENT MILE INDEX.

THIS contrivance for measuring and indicating the distance travelled by carriages, has been invented by Mr. H. Von Uster. The invention is equally applicable to private carriages as to cabs and other public vehicles; one of its advantages being that there is nothing unsightly in the apparatus—which can scarcely be seen when the carriage is in motion. A plano-spiral rotator is concealed within the hoop of the nave of one of the hind wheels, and gives action to a shaft or small rod of iron which is carried horizontally nearly as far as the opposite wheel. At this point a universal joint connects the horizontal with the vertical rod, which latter continues the action into the body of the carriage under the seat. Here two or three wheels give motion to a suitable shaft or chain, which is concealed between the pannels of one side of the carriage, and terminates near the roof in a dial plate provided with two faces, one inside, for the use of the passenger, and the other outside, in which the driver and his fare can together note the position of the hands before the latter steps into the cab. Both dials have exactly the face of a clock; being each furnished with an hour and a minute hand—and hours, half-hours, and minutes, being indicated on the dial precisely as in the ordinary time-piece. As the

hands perform the circuit of the dial, the divisions of hours, half-hours, and minutes, correspond exactly with the miles, half-miles, and fractions of a mile actually traversed by the vehicle. Thus, if the dials indicate 20 minutes past 12 when the passenger enters the cab, he will know that he has travelled exactly a mile when the dial within points to 20 minutes past 1—a mile and a half when it points to 10 minutes to 2—two miles when it arrives at 20 minutes past 2—and so on. A small circle within the dial face, with a pointer answering to the second hands of a watch, enable the owner of the carriage to satisfy himself as to the total number of miles which the vehicle has travelled in any given period. The passenger is thus supplied with a perfect check against overcharge; while the proprietor has the means of knowing the amount of mileage actually performed. —*Athenæum*, No. 1029.

VOTE-TAKING MACHINE.

A CONVICT in the States Prison of New Jersey, has invented a machine for taking the "yeas" and "nays" in legislative assemblies. When put into use, it is to stand at the clerk's table, and from it two wires are to extend to the desk of each member, terminating in two knobs, one of which should be marked yea, and the other nay. When the question is to be taken, and it is announced by the chair, the clerk unlocks the machine by touching a spring, and every member pulls one of the knobs attached to his desk. If he wishes to vote yea, he pulls the yea knob; if he wishes to vote nay, he pulls the nay knob; the whole being done simultaneously and in a moment. The clerk then turns a small brass crank, part way round, and then figures appear before him, in the machine, one of which gives the number of yeas, and the other the number of nays which have been voted, and the third the aggregate of all the votes taken. At the same time, and without any additional movement, the yeas and nays are all distinctly registered on the clerk's catalogue of members, which is printed pretty much in the usual form; the persons voting being marked by a small round hole pricked through the paper. All these operations are done with unerring certainty, and the whole should not require more than a single minute. The size of the house, or the number of members, will make no difference in the time required. As soon as all the members who wish to vote have pulled their wires, the work is complete. The clerk then has only to turn his crank, and in an instant the number of yeas and nays, and the aggregate votes, stands before him, in large figures, and all that he has to do is to declare the result. His marked register will, at the same time, show how every member has voted."—*Boston Daily Advertiser; Mechanics' Magazine*, No. 1230.

SEWING-MACHINE.

THE American papers mention a Machine invented by one Elias Howe, which Sews beautiful and strong seams in cloth with great rapidity. The following claims are in the words of the patentee:—

"The lifting of the thread that passes through the needle eye by the lifting rod, for the purpose of forming a loop of loose thread that is to be subsequently drawn in by the passage of the shuttle; said lifting rod

being furnished with a lifting pin, and governed in its motions by the guide pieces and other devices.

"The holding of the thread that is given out by the shuttle, so as to prevent its unwinding from the shuttle bobbin, after the shuttle has passed through the loop; said thread being held by means of the lever, or clipping piece.

"The manner of arranging and combining the small lever, with the sliding box in combination with the spring piece, for the purpose of tightening the stitch as the needle is retracted.

"The holding of the cloth to be sewn by the use of a baster plate, furnished with points for that purpose, and with holes enabling it to operate as a rack, thereby carrying the cloth forward, and dispensing altogether with the necessity of basting the parts together."—*Mechanics' Magazine*, No. 1231.

ASHE'S SAFETY BANK LOCK.

Mr. W. Ashe, of New York, has patented a new Lock, which, according to the *Scientific American*, is expected to supersede all other bank, and safe locks, on account of the impossibility of its being picked or opened by any person but by the person by whom it was last locked. As there is no key required, and, consequently, no key-hole—and as any person making an attempt to open it cannot, possibly, tell the stage of progression unless he is made acquainted previously with the secret—and even should he be informed how to open it one time, the person closing the bank, safe, or store, or whatever may be the place secured, can so alter the arrangements, that no other person but himself can open it again; the manufacturer of the lock being himself equally incapable, without information as to the state of the lock previous to its being shut. The principal construction of the lock is a number of counter bolts, passing through the main bolt, acted upon by screws each having eight or ten turns: the more screws and bolts, the more difficult it would be to open it; but four screws having ten turns, doubled and quadrupled, by halves and quarters multiplied by the number of screws, make the variations calculable. Supposing the screws be all turned at random, after any attempt to open it; the person acquainted with the manner of opening the lock proceeds to turn all the screws to the far end, as far as they will go: then he knows the number of turns or half turns required to bring all the counter-bolts, with the apertures, to such a position as to admit the passing of the bolt, which flies open by the action of the spring, when properly arranged. It would be as easy for a man to sit down and play all the games that can be played on a chess-board—or to attempt to spell all the words that could be spelled with the twenty-six letters of the alphabet—as it would be for him to turn the screws to all the variations they are capable of being placed in.

NEW SAWING-MACHINE.

Prof. Faraday has described to the Royal Institution, a working model of a Sawing-Machine, invented by Mr. Cochran. By this engine wood can be cut into curves of *double curvature*, (*i. e.* curves in two

planes.) This is effected by the saw being made to turn on a vertical, while the wood is turned at the same time on a horizontal, axis.

JONES'S MORTICE CUTTING-MACHINE.

THIS new machine is thus described in No. 221 of *The Builder*:—"It consists of an upright frame, in front of which, at a convenient height for the workman, is fixed a piece of timber, called the table, on bolts working in slots in the front of the frame, to regulate the height of the board in which the mortice is to be cut. The mortice-chisel is fitted into a collar, turning in an arm at the top of the machine; and this arm is adjusted to the thickness of the timber to be morticed, by means of a slide. This collar is connected by a vertical rod and springs, with a treadle, and while the wood is guided by the hands of the operator, the rapid action of his foot on the treadle brings down the chisel, and forms the required mortice in a very short space of time, and much more truly than it could be done by hand: the action of the springs is to force up the tool from the wood, the latter being kept firm in its place by two projecting brackets. The saving in time must be very great. We trust the inventor will reap the reward of his ingenuity, and we do not hesitate to direct attention to the machine."

CASK-HEADING MACHINE.

A CORRESPONDENT of the *Scientific American*, writing from Brunswick, Me, informs us that a Machine for cutting out and chamfering Headings for Casks, has been invented and put in successful operation in that place, and cuts out a thirty-two inch head in less than one minute. The following is given as a brief description, though it will not be readily understood without an illustrative cut or drawing. The outer frame consists of two upright posts, with two horizontal girths. On the lower girth lies a circular table, in which a number of brads or spurs are inserted, to prevent the pieces from spreading after being jointed and dowelled. Between the girths is a sliding frame, to which is attached a plane or spoke cylinder of a diameter to suit the heading to be cut. This cylinder is confined to the sliding frame by a hollow iron shaft, on which is a tight and loose pulley for propelling the machine. Through this shaft extends an iron rod, on the lower end of which is confined a clamp or collar, which is pressed down by a weight or lever to hold the boards upon the table containing the spurs, as before named. In the outer surface of the cylinder are grooving tools or cutters confined by keys or screws. The sliding frame is pressed down by a lever, and raised by a weight or spring. In connection with the grooving tools are cutters for levelling the chime. See "Cask-making by Machinery," Year-book of Facts, 1847, p. 82.

NEW DRAINING-TILE MACHINE.

THIS invention, patented by Mr. W. Hodson, of Hull, consists of clay being taken from the solid earth and put into the Machine, where it is tempered or manufactured into draw or pipe Tiles at one operation. From one to twenty pipes, or tiles, can be produced at a time, without the aid of manual labour, further than wheeling clay to the machine,

which is worked by one horse; consequently, hand labour is superseded, and likewise all pipe tile making by hand machines, which have hitherto been brought before the public. Stony clay is of little importance to the machine, as all stones are crushed before the operation of forming the pipe or tile; which will be the means of using some clays that, although of a good quality, could not be brought into use.

OSBORNE'S STEAM PLOUGH.

THE practicability of applying Steam power to the Plough has formed a problem of some thirty or forty years' standing, and has engaged the attention of many ingenious men; but to this day it remains unsolved—ploughing by steam is practised nowhere. Yet, to assume the thing impossible, would be to admit a limitation to the powers of steam and the resources of mechanical art, strangely at variance with the all-subduing character of their past triumphs.

To effect this great object, Mr. J. T. Osborne, of Demerara, has patented a plan, which seems chiefly distinguishable from those which have preceded it in the employment of two engines and two ploughs for each course of ploughing, (instead of one of each;) each engine being fitted with two drums, and ropes or chains, which cause a simultaneous and reciprocating progression of the two ploughs in opposite directions. The following details we extract from Mr. Osborne's specification:—

First.—To till, by means of steam or other power, an open field or piece of land, not intersected by roads, or canals, or wide ditches, I make use of two locomotive engines, similar to those used on railways, except that the power of the pistons is differently applied. I place them on the land to be tilled, at distances of from 100 to 200 yards apart, and exactly opposite the one to the other. I cause them to traverse the land on temporary rails, laid for the purpose in parallel lines, at right angles to the direction in which the land is to be tilled, that is to say, in which the furrows are to run; and I employ the pistons of each engine to produce, by means of intermediate gearing, a continuous revolution of two drums, placed on the near side of each engine, or that side which faces the opposite engine, and on the same framework as the engine, which drums have attached to them chains or ropes, by means of which two ploughs, or other tilling machines, are simultaneously drawn in opposite directions from one side of the field to the other. In order that the ploughs and ropes, or chains, may be correspondingly advanced, the following arrangements are adopted. Each plough is provided with an extra outrigger (laid loosely on two crutches affixed to the plough frame) of a length equal to the breadth tilled by each plough in each entire remove of the engines, and the breadth of one furrow more, which extra outrigger is substituted for the other, when the plough comes to its last course of work, (in each remove,) so that it shall lay down the chain or rope for the next return course on the advanced line, at which that plough has to resume operations.

Each plough again, when it comes to the end of its last course of work, is directed by the person superintending its operation on to an inclined plane, attached by hinges to the near side of each engine, which gradually

raises it free off the ground, and on which it is held till the remove of the engines has been effected. And so the work goes on till the whole field has been ploughed. Rails may be laid down at once for the whole distance which the engines have to travel over, or two lengths only may be made use of, one to be always employed in sustaining the engine, and one to be taken up from behind at each entire remove forward of the engine, and rescrewed into the front ends of the rails left on the ground.

Secondly.—Where the field to be tilled is bounded on the two sides along which the engines have to travel by canals or ditches filled with water of depth enough to float boats or punts, I place the engines in such boats or punts, and make the drums to slide on their axes, so that they can be raised or lowered to suit the relative levels of the ground and water. An arrangement of this description is represented in fig. 5 of the annexed engravings. Or should the field, though thus bounded on two sides by canals or wet ditches, happen to be of too great a width to be mastered at one ploughing or tilling, I make use of each canal or ditch as a substitute for one line of rails only, and lay the other on the ground, as in the case first hereinbefore provided for.

Mr. Osborne concludes by describing in his specification several sorts of ploughs proper to be used in combination with power engines on the preceding plan.—(See No. 1225 of the *Mechanics' Magazine*, for the illustrated details.)

BOWER AND PETIT'S SCREW PLOUGH.

This is an ingenious application of that most powerful instrument, the Screw, to the tilling of land; but how far it is calculated to supersede the straight-going ploughs now in use, practice only can determine. We can suppose that a plough of this sort might be applied with advantage to light soils, but should doubt its applicability to wet and clayey lands. The inventors describe their invention as employing a tiller formed of a cylindrical shaft, or drum, having a number of radial cutters, or prongs, or tines, either straight or curved, attached thereto, at right angles, and arranged round it spiralwise, so as to present the appearance of a screw, and in combining therewith the mechanical auxiliaries necessary for the same to penetrate the soil.—(For the details of this invention, see No. 1225 of the *Mechanics' Magazine*.)

NEW ZEALAND FLAX.

M. Boussingault has read to the Academy of Sciences, at Paris, the report of a committee on a paper by M. Vincent relative to the means employed, in detecting by a chemical test the admixture of *phormium tenax*, or New Zealand Flax, with the hemp and flax of European growth and preparation. It appears that the *phormium tenax* does not possess certain qualities essential for naval cordage, and it was considered important to discover the means of detecting the presence of this article. M. Vincent has found that if the *phormium tenax* be immersed in pure nitric acid, its fibres, owing to the presence of some azotic substance, take a blood-red tint; which is not the case with the hemp and flax admitted for use in the navy. Thus it is very easy, by subjecting a rope to the action of

nitric acid, to discover whether there has been any admixture of *phormium tenax*. The Report of the Committee confirms the statement made by M. Vincent.

PIGMENT TO RENDER WALLS IMPERVIOUS TO MOISTURE.

We have lately seen specimens of cement, stucco, and imitations of jasper, marble, porphyry, and agate, of considerable beauty, formed, as we are told, by a process derived from the Chinese. The leading feature of these operations is the conversion of common cheap materials into substances of value to builders:—1st. A cement, equal in other respects to Parker's, which, as is asserted, remains uninjured by the heat of chimneys or of the sun, and impervious to frost.—2d. An easy mode of reconverting sand or pulverized carbonate of lime into compact stone.—3d. Imitations of various sorts of crystallized minerals, more diversified than scagliola; and, 4thly. A vitreous surface, which is applied with the brush over the other substances in thin coats, like paint. Mr. W. Couch, the possessor of these secrets, is an old plasterer,—in early life foreman to James Wyatt, and afterwards, for ten years, in a similar capacity to Messrs. Cubitt, whose service he left to go abroad. He visited Canton, South America, and the Sandwich Islands, where he obtained a knowledge of some things which he believes to be unknown in England. An able artist, who has examined the Vitreous Pigment, says, it appears to be a complete answer to one important query of the Royal Commission as to the success of fresco painting, and would, in many ways, secure architects and builders from annoyance from wet and expansion, consequent on moisture. The cost of the new Pigment, or varnish, is fourpence per square yard for each coat, two or three being required.—*Abridged from The Builder.*

PNEUMATIC INSPIRATOR.

This instrument has been invented by Mr. Startin, for the use of Dry Grinders, Divers, Firemen, &c.; also for the Administration of Sulphuric or other Medicated Vapours. To give an idea of the extent of this evil, we need but refer to the statistics of mortality among dry grinders of needles or cutlery; by which it appears that the majority of deaths occur between the ages of 26 and 30. After enumerating the various trades by whom such an instrument might be used with advantage, the writer proceeds to describe the apparatus—which consists of a thin case of metal, glass, or other substance, $1\frac{1}{4}$ inches deep, $2\frac{1}{4}$ long, and $3\frac{1}{4}$ in breadth at the base; and is so constructed as to cover the mouth and nostrils, and is retained on the face by an elastic band. This case is provided with two valves, made of vulcanized Indian rubber. One is in front of the case, and opens outwards; the other is in the bottom, below the mouth, and opens inwards. A tube is attached to the case below the latter valve, and opens into the external air: or it may be fixed to a vessel carried in the folds of the dress, and arranged with a tube having one opening to the air, whilst its lower extremity is immersed in a fluid which shall absorb or neutralize the noxious particles,

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M. SOYER'S MODEL SOUP KITCHEN.

DURING the late scarcity of food in Ireland, M. Soyer, the *chef-de-cuisine* of the Reform Club, submitted to the Government a novel plan for the construction of a Kitchen, by which great economy of materials might be secured; and upon this suggestion M. Soyer was commissioned to construct a depôt at Dublin, which has been fully to answer its purpose. As the plan is original and ingenious, we subjoin its details:—

The exterior and covering is of boards and canvas, enclosing a space of 48 feet long, and 40 feet wide.

The interior consists of a steam-boiler, on wheels, 13 feet long, and 4 feet wide, with a glaze-pan over it, capable of containing 300 gallons, and at the end an oven, to bake 1 cwt. of bread at a time; all heated by the same fire. Under the boiler is an excavation to contain coals, and round it an elevated platform, to give access to the glaze-pan. At the distance of 8 feet, round the boiler, are 8 iron *bain-marie* pans, with covers, 6 feet long and 22 inches wide, on wheels, and made double, to be boiled by steam, and contain, together, 1000 gallons. At each end, extending between the pans, are the cutting-tables—at one end the meat, and at the other the vegetables; and under which are placed wooden soaking tubs, on wheels, and chopping-blocks for the meat-drawers and sliding-shelf. Four feet beyond these is placed a row of tables, 18 inches wide, in which a hole is cut, and therein is placed a quart iron white enamelled basin, with a metal spoon attached thereto by a neat chain: there are 100 of these, and this table forms the outer boundary of the kitchen; leaving a space of 2 feet 6 inches between it and the wall. Inside of the table are fastened tin water-cases, at the distance of 10 feet apart, containing a sponge, &c. to clean out the soup-basins.

Round the two supports of the roof are circular tin boxes for the condiments. Seven feet from the ground, at each corner, is placed a safe 5 feet square and 7 feet high, with sides of wire, for ventilation, which contains, respectively, meat, vegetables, grain, and condiments. At the same elevation as the safes are sixteen butts, containing 1792 gallons of water.

At the entrance, in the centre, is the weighing machine. The fire being lighted, a certain quantity of fat or dripping is placed in the glaze-pan, and in the soup-pans the farinaceous ingredients, or thickening, along with the water. As soon as the fat is melted in the glaze-pan, the vegetables, cut into thin slices, or dice, are placed therein; after the lapse of ten minutes, the meat, which has been previously cut into small pieces, is added, and allowed gradually to fry, until the juice is extracted, and a good glaze formed, which will be in about 35 minutes.

The condiments are then added, and the glaze is removed, and distributed equally in the bain-marie pans: it is boiled for 20 minutes, and the soup or food is complete. This is the time used in making the soup, when such farinaceous ingredients as flour, oatmeal, and rice or barley, previously soaked, are employed; but peas, Indian corn meal, and many other ingredients, will take longer boiling. It is then ready to be removed by ladles into the basins in the surrounding tables. Outside the tent is a zigzag passage capable of containing 100 persons in a small

space in the open air; at the entrance is a check-clerk, and an indicator, or machine which numbers every person that passes; and on the other side is a bread and biscuit room, where those who have partaken of the soup, and are departing, receive, on passing, a quarter of a pound of bread or savory biscuit.

MANUFACTURE OF SALT.

A PLAN has been submitted to the Polytechnic Institution, of an improved apparatus for the Manufacture of Salt; by means of which it is estimated that six pounds of Salt can be produced for each pound of coal employed in the process. One feature in this improvement consists in part in keeping up a partial vacuum by means of air-pumps. It appears to us, however, that this branch of business may be brought nearest perfection by evaporating the brine in covered air-tight kettles or cauldrons, and conducting the steam into the top of a tall cistern—say 25 feet high and 5 feet in diameter—nearly filled with cold water, and communicating at the bottom with a river or pond, but without admitting air. The communication between the boiler and the cistern must be kept closed till the boiler is adjusted, and then being opened, the steam will be condensed as fast as it passes into the cistern, and the weight of water in the cistern will tend to maintain a vacuum in the boiler, without the use of air-pumps. If the surface of the water in the cistern become too much heated by the steam, a very slight agitation will bring up the cold water from the bottom, while the heated water will pass out of the cistern (which may be entirely open at the bottom) into the river or lake below. This cistern or cylinder may be made of wooden staves and hoops, and the external atmospheric pressure will tend to keep it tight and secure. A similar method might be employed to advantage in the manufacture of sugar.—*Patent Journal*, No. 44.

ETHERIZATION OF BEES.

MR. HILTON, of Great Marylebone-street, the author of the "Practical Bee-Keeper," has applied Ether to Bee-hives, in order to reduce the Bees to a state of stupefaction, whilst the comb and honey are removed. The apparatus used is very simple. "The ether was put into a glass vessel, to which a flexible tube was affixed, which was introduced beneath the hive (a glass one) through a small hole in a platform on which the hive was placed. The glass vessel was then set in a larger vessel of warm water, by which the vapour was subtilized. In seven minutes the vapour completely stupefied the bees, who fell inanimate to the bottom of the hive. The hive was then removed. The atmospheric air revived the bees in about ten minutes, and in a short time after they were fully recovered. The same effects were then produced by the fumes of burnt nitre in another glass hive. The stupefaction of the bees was more immediate; but their recovery on exposure to the atmospheric air was obtained. Another experiment was made on a third hive, by igniting the species of dried fungus called a 'powder-puff,' and the result was similar. The use of Ether, however, appeared more manageable, the strength being more capable of regulation than that of either the nitre or the 'powder-puff.'

It was, moreover, more cleanly, and less likely to occasion accidents." The honey is not likely, it is said, to be affected with the vapour of ether. It is so extremely volatile, that its powers are dispersed by the atmospheric air almost immediately. The *Toronto Banner* states, that the Albany butchers now administer ether to the animals which they are about to slaughter.

PURIFICATION OF WATER.

Prof. Solly, in a paper read to the Royal Institution, has suggested various methods of Freeing Water from Impurities. Carbonate of lime is decomposed by the mixture of muriate of ammonia with the water which contains it. This practice has been found efficacious in preventing deposits in steam-boilers. Gypsum may be thrown down in the form of carbonate of lime, by adding carbonate of soda. A very ingenious process for the same purpose was also exhibited:—by filtration through oxalate of baryta, sulphate of lime is entirely separated from its solution. This operation may still leave a trace of the oxalate of baryta in the purified water. This small contamination, however, may be entirely removed, by making the fluid pass through a second filter of phosphate of lime; when the water will become perfectly pure.

STEREOCHROMY.

A communication from Professor Schottlauer, ot Munich, acquaints us with particulars of a new invention for painting upon walls, discovered by himself, conjointly with Herr Fuchs, Counsellor of the Mines, to be called Stereochromy. Its peculiarities are stated as follows:—

"Far greater ease in its manipulation than fresco. The ground is not laid in patches, but by one single operation. The colours, prepared in distilled rain-water, take such firm hold as not to be disturbed or altered by any subsequent washings or shades, while the process of painting may be carried on with any amount of intervals, thus rendering a far richer finish possible than with fresco. After the picture is finished, it is saturated with a fluid, which unites the ground and the colour into a mass of the consistency of stone; desiccations being thereby rendered impossible. The colours are of greater strength and brightness than with fresco, though without the slightest glare or reflection as of oil. It resists all atmospheric influences,—humidity, evaporation, &c. A test no less extreme than the burning of alcohol, has been applied to it, without the slightest change or deterioration."—*Athenæum*, No. 980.

BEET-ROOT BREAD.

M. Payen has communicated to the Academy of Sciences, at Paris, an account of the Use of Beet-root in the making of Bread. He commenced by observing, that hitherto most of the substances proposed as an economy in panification, have presented disadvantages more or less serious. The flour of potatoes communicates a disagreeable taste, owing to the essential oil; and by the addition of the potato in the mass the bread becomes more compact and less nutritive. The flour of beans, peas, haricots, &c., may increase the quantity of nutritive power in bread; but if the proportion be large the bread becomes more brown, more heavy, and of an unpleasant taste. The use of beet-root, says M. Payen, is at-

tended with very different results. Bread made of equal parts of beet-root and wheaten flour presents difficulties in the panification; but in the proportion of one-third beet-root and two-thirds flour there is no difficulty in the making or baking, and the taste of the bread is agreeable even when it is five days old. In order to ascertain the nutritive qualities of bread thus prepared, M. Payen submitted it to a chemical analysis; of which the following are the results:—In the first place, it contains 35 per cent. of water. In admitting, according to the analysis, first, 12 per cent. of water in the flour, 13 of azoted substances, 6 of sugar, dextrine and cellulose, 67 of starch, and 2 of saline matter,—second, in the beet-root 85·5 of water, 14½ of dry substance representing 1·36 of azoted substance, 0·8 of saline matter, 1·55 of cellulose, pectine, fatty matter, &c., and 10·8 of sugar, we find, as has been proved by direct analysis, that bread, in the making of which 33 per cent. of beet-root has been used with 67 per cent. of flour, differs chiefly by a slight diminution of azoted substance from that in which flour alone has been used. This difference, however, is equal to only 0·66 per cent. Bread made from flour alone, contains 9·75 per cent. of azoted matter; bread made of two-thirds flour and one-third beet-root, contains 9·10 per cent. of azoted matter. Thus, in point of nutrition, the beet-root bread made as above stated, is, with a difference scarcely worthy of notice, as nutritious as bread made entirely of flour.

PRESERVING FRUIT AND VEGETABLES.

Mr. Newton, of Chancery Lane, has patented certain improvements in Preserving Fruits and Vegetables. This invention relates to an apparatus for the purpose of maintaining the temperature of the fruit, vegetables, &c., to be preserved, at the constant temperature of 32° Fah., or thereabouts; it is thus constructed:—an oblong pit is excavated in the earth, and lined on all sides with a brick wall; at a little distance within this brick wall another of plank is built, and again within this another; and between these two plank walls, charcoal, tan-bark, or any other bad conductor of heat, is loosely packed. The space included by the planking is divided into two equal compartments, by a double plank partition, packed as above described: one of those compartments is to serve as an ice-store, the other to contain a box which fits to the compartment, and in which the fruit, vegetables, &c., are to be placed: this box is surrounded by several tubes, for the purpose of holding water, and are so placed that the water can be added with facility: the cover of this box is in the form of a flattened pyramid, with a trap-door in it, by which the box is filled or its contents removed, as required. The ice compartment has a similar cover. On the cover of the ice-store, and also on the cover of the fruit-store, a small quantity of ice is placed, which by thawing, and the ice-cold water trickling down through the packing, between the planks above described, maintains the fruit, &c., at an uniform temperature, but should the temperature sink below freezing point (which would injure the fruit), then water is to be poured into the tubes. Surrounding the fruit compartment, a channel is provided, by which the water from the melting ice runs off. When the apparatus is in use the whole is roofed in with shallow pans, containing charcoal dust, or any other non-conductor of

heat. The preserving apparatus may be constructed without the ice-store where a supply of ice is kept or easily obtained.

The claim is for the preserving apparatus, above described, either with or without the ice-store.—*Patent Journal*, No. 44.

PROFESSOR SCHOENBEIN'S IMPROVEMENTS IN PAPER.

THE author has discovered a method by means of which the following properties may be given to the paper in common use :—

1. Prepared paper has much more tenacity and greater consistency than common paper.

2. When dipped into water it does not lose its consistency, but is affected as parchment would be.

3. It receives with equal facility both writing and printing ink.

4. It does not require sizing to render it suitable either for writing or printing.

5. The injurious effects produced by the chloride of lime are avoided in prepared paper.

M. Schoenbein states that his process is simple, inexpensive, and easy of application, and that the new paper offers many advantages, particularly for bank notes and for paper hangings.

The vegetable fibre of this paper renders it possible to make of it a substance as transparent as glass, and impermeable to water. The anthor has made of it bottles, balloons, &c., the sides of which may be made as thin as a plate of mica.

Another property of this paper is, that it developes a very energetic electric force. By placing some sheets on each other, and simply rubbing them once or twice with the hand, it becomes difficult to separate them. If this experiment is performed in the dark, a great number of distinct flashes may be perceived between the separated surfaces. The disc of the electrophorus, placed on a sheet that has been rubbed, produces sparks of some inches in length. A thin and very dry sheet of paper, placed against the wall, will adhere strongly to it for several hours if the hand is passed only once over it. If the same sheet is passed between the thumb and forefinger in the dark, a luminous band will be visible. Hence it is believed, that this prepared paper will answer to make powerful and cheap electrical machines.—*Letter from M. Schoenbein to M. Dumas; Mechanics' Magazine.*

ORNAMENTAL GLASS.

MR. APSLEY PELLATT* has read to the Royal Institution, a paper "On the Manufacture of Ornamental Glass." Having referred to a discourse delivered at the Royal Institution by his brother last session, "On Plate, Crown, and Bottle Glass," Mr. Pellatt characterized flint glass as distinguished from these, by having oxide of lead as one of its ingredients. It is to this material that flint glass owes its peculiar brilliancy. Having described the process of mixing the materials, Mr. Pellatt stated that this

* Mr. Pellatt has in the press an elegant volume entitled, "Curiosities of Glass-making," in which the rarest productions, as well as the most beautiful processes of Ornamental Glass Manufacture, will be described, and illustrated by coloured engravings.

mixture was exposed to intense continuous fusion for from forty-eight to sixty hours, so as to drive off all interstitial air bubbles. He further stated that if this fusing heat were continued too long, a greenish tinge and a gelatinous structure would be communicated to the glass. He concluded this part of his subject by inviting attention to a lump of flint glass mixed and fused by a committee consisting of Sir H. Davy, and Dr. Wollaston, at the Falcon Glass Works.

Mr. Pellatt then proceeded to illustrate not only by diagrams, but by the actual process performed by his workmen, (a "little-go" furnace having been fitted up by him in the Institution for this object)—the *physics of glass manufacture*, the effects of rotary motion, of the simple force of granulation, of cohesion, as exhibited in the mode of shaping wine-glasses, &c., and drawing tubes. The operation of *wetting off* (*i. e.* the contraction and consequent fracture of the glass on the sudden application of cold) was also described. Mr. Pellatt next detailed various other manipulations, as the peculiar welding of glass by contact. He noticed the projecting moulded pillars which exhibit the brilliantly refractive effect of cut glass; and mentioned that these, though invented recently by Mr. James Green, appear from the similarity of their exterior as well as interior structure, to have been manufactured by the ancients by the same process as is adopted now. This was inferred from the similarity of structure of a specimen of Roman glass dug up in the City of London. The operation of moulding glass was exhibited; and an ingenious machine for blowing phials of uniform size, without seam, was shown. The elasticity of glass was illustrated by the rebound of glass balls of about three inches diameter from a polished iron slab to about three-quarters of the height from which they were dropped.

Mr. Pellatt next entered on the philosophy of annealing as a contracting process, and experimentally exemplified its effects. He mentioned that barometer and thermometer tubes were often left unannealed, because in that state they contracted only half as much as if they were annealed. The process of *casing* (*i. e.* of laying colours on white glass) was then practically shown by the workmen, who covered a white toilette-bottle with blue about the thickness of an egg-shell.

Mr. Pellatt exhibited a vase of the exact size and shape of the Portland Vase—having a thick exterior coating of dark blue glass on which a white enamel glass casing was laid. The engraver had cut away portions of the white, leaving masses of blue on the neck and upper part of the vase exposed to view; and had chased out at the lathe, and with the engraving tool, a portion of the bas-relief. This vase was manufactured at the Falcon Glass Works. Having adverted to the authorities who maintain the material of the Portland Vase to be glass, Mr. Pellatt exhibited a full-sized drawing of an ancient vase now in the Museum at Naples. This vessel was made of blue glass, and cased with white enamel, in which various subjects were engraved in relief. He took this occasion of declaring that if any British engraver of adequate skill, should propose to make an exact copy in glass of the Portland Vase, his firm would undertake the manufacture of the vessel. Having described the process of cutting glass, and exhibited the lathes, wheels, &c., by which

that operation is performed, Mr. Pellatt explained, that, in ornamental glass (as decanters) the brilliancy varied inversely with the flutes on the cylindrical surface of the vessel. This condition of pellucid refractibilty depended on the quantity of flat surface cut away from the *exterior* of the cylinder.

The last process exhibited by Mr. Pellatt's workmen was the drawing *Venetian filagree cane.* Threads of white and coloured glass were placed vertically round the interior surface of a brass mould; a solid flint glass ball was blown among the threads so as to weld them to its outside surface. The whole was then drawn in the manner of *tube* and *cane;* except that each workman twists in an opposite direction so as to produce a spiral. Specimens of mosaic glass were also shown. These consist of canes pressed together, having been previously arranged according to the required pattern, and then cut off into slabs at right angles to their length. Venetian *millefiore* glass was explained to consist of single canes of filagree glass cut off into small lozenges—which, when placed side by side, are welded to flint glass. In conclusion, Mr. Pellatt explained the enclosing cameos in shut-up *pockets;* and exhibited a specimen of a glass pedestal containing inclosed within it a caryatid figure.

SILVERING GLASS.

Mr. T. Drayton has communicated to the Society of Arts, his Patent Process for Silvering Glass with Pure Silver. The table used by me, he says, in silvering, is of a similar description to that ordinarily used—the glass being fixed horizontally upon it by means of machinery. It is necessary that the piece of glass should be perfectly level, so that the liquor poured on shall act equally on all parts of the surface. The material used consists of nitrate of silver, to which are added ammonia, water, spirits of wine, and thirty or forty drops of oil of cassia. In this state the liquor can be kept for a long time without deteriorating. When it is required for silvering, oil of cloves is to be added to it; and in proportion to the quantity of oil of cloves added is the length of time required to perfect the deposit. The deposit takes place equally well whether the surface is flat or of any other form. After it is silvered, it is washed to remove the impurities which have been deposited with the silver; and then placed in a hot-air closet, where it remains for a few hours until perfectly dry, when it is varnished to protect it from the action of the air, and also from being scratched. Glasses of any dimensions may be silvered in the most perfect manner in forty-eight hours. The silver deposited by this process adheres more firmly than does that by the old method. It is also less injurious to the health of the workman—as mercury is not used: and the cost of production is not increased.

MANUFACTURE OF ROMAN MOSAICS.

Mr. D. Wyatt, in a paper read by him to the Society of Arts, "On the Art of Mosaic," thus describes the manufacture of Roman Mosaics: —A plate, generally of metal, of the size of the picture to be copied, is first surrounded by a margin, about three-quarters of an inch from its surface. This is then covered over with a coating of perhaps one-quarter

of an inch in thickness of mastic cement, composed of powdered Travertine stone, lime, and linseed oil. This is, when set, entirely covered with plaster of Paris, rising to a level with the surrounding margin, which is intended to be exactly that of the finished mosaic. On this is traced a very careful outline of the picture to be copied; and, with a fine chisel, just as much is removed, from time to time, as will admit of the insertion of the little pieces of glass mosaic—or, as the Italians call it, "smalto." This smalto is composed of glass, and is made in ronnds, about six or eight inches in diameter, and half an inch thick. The workman then proceeds to select from the great depository, wherein are preserved, in trays, nearly 10,000 varieties of colour, those he may require,—which he works to the necessary shape. This is done by striking the smalto with a sharp-edged hammer, directly over a similar edge, placed vertically beneath. The concussion breaks the smalto to very nearly the shape required; and it is then more perfectly ground, by application to a lead wheel covered with emery powder. The piece thus shaped is then moistened with a little cement, and bedded in its proper situation: and so on, until the picture is finished; when the whole is ground down to an even face, and polished. Six regularly instructed artists are now constantly employed in the Fabrica, at the Vatican.

SHELL CAMEOS.

Mr. Gray has read to the Society of Arts, a communication on the Manufacture of Shell Cameos. The author commenced by stating that the ancients formed Cameos by engraving figures in low relief on different kinds of siliceous stones; and generally selected for that purpose those which had layers of different colours; so that the figures, or different parts of the same figures, were of divers colours. Such Cameos are now made in Southern Europe and in France, where this art has lately been attempted to be revived; but the hardness of the materials requires so much labour, that they are too expensive to come into general use. Numerous attempts have been made to substitute various materials, such as porcelain and glass, for the ancient Cameos; but their great inferiority has caused them to be neglected. The best, and now most used substitutes, are Shells; some kinds of which afford the necessary difference of colour, and are at the same time soft enough to be worked with ease, and hard enough to resist wear. The shells used are those of the Flesh-eating Univalve—which are peculiar, as being formed of three layers of calcareous matter, each layer being a perpendicular lamina placed side by side. The Cameo-cutter selects those shells which have the three layers composed of different colours, as they afford him the means of relieving his work; but the kinds now employed, and which experience has taught him are best for his purpose, are the Bull's Mouth, the Black Helmet, the Horned Helmet, and the Queen Conch. The two first are the best shells. After detailing the peculiarities of these Shells, the writer proceeded to give an account of the progress of the art, which was confined to Rome for upwards of forty years, and to Italy until the last twenty years; at which period an Italian commenced the making of them in Paris; and now about three hundred persons are employed in this branch

of trade in that city. The number of shells used annually, thirty years ago, was about three hundred, the whole of which were sent from England—the value of each shell in Rome being 30s. To show the increase of this trade, the number of shells used in France last year was nearly as follows:—

Bull's Mouth	80,000,	average price	1s. 8d.,	value	£6,400
Black Helmet	8,000,	,, ,,	5s. 0d.,	,,	1,800
Horned Helmet	500,	,, ,,	2s. 6d.,	,,	60
Queen Conch	12,000,	,, ,,	1s. 2½d,	,,	700
	100,500 shells			sterling	£8,960

The average value of the large Cameos made in Paris is about 6 fr. each; giving a sterling value of £32,000; and the value of the small Cameos is about £8,000,—giving a total value of the Cameos produced in Paris, for the last year, of £40,000; while in England not more than six persons are employed in this trade.

PORTRAIT MACHINE.

A MACHINE has been invented by Mr. Kingston, called the Carsoetype, the object of which is to give certainty in drawing the lines of the human face; it being reasonable to desire not only a greater certainty of *contour* than can be effected by the unassisted eye, but that we should see also the exact size of the several features and of the head, so that in after days the portrait may be referred to as a *fac-simile*. This Mr. Kingston appears to have effected, and with so little trouble to the sitter as to require an attendance in the Machine but of one minute; during which time there is no unpleasant sensation felt, as nothing is to be seen, save the reflected image of the face. The portrait, in its shadowings, is afterwards completed by art on a ground of marble; since, as the artist observes, no machine can ever enable the sitter to hold a steady and pleasant eye or lip, the very effort so to do entirely disarranging their pleasurable composure. The style of finish given to these heads is entirely new—is full of beauty and strength, and we understand their durability to be unquestionable.—*Patent Journal*, No. 32.

PICTURE-FRAME MAKING BY MACHINERY.

BY this invention, patented by Mr. Bielefield, any of the common forms, technically termed ogee, ovolo, bevel, hollow, &c., can be enriched with the most delicate work, similar to engine-turning, or by relieved arabasques of any design. The principle is new, as applied to manufacture of this kind: it is simply to pass any length of a frame under a roller in which is cut the desired pattern. This roller, the radius of which is but a few inches, is turned out of a rough cast of gun-metal, and is driven by a steam-engine. The wood which is passed under it is necessarily soft—say the best pine—and receives at any length the impress of the most delicate tracery which can be engraved on the metal. The advantages of this are sufficiently apparent; but there are yet others which may be mentioned. The wood comes from the machinery ready for gilding, or complete as an imitation of ebony or Florentine bronze, and also

in colours, and having preserved on the surface the design in all its sharpness, which would be deteriorated by the ordinary method of whitening and sizing.—*Abridged from the Art-Union.*

CARVING BY MACHINERY.

Mr. Jordan has read to the Society of Arts, a paper on the New Carving Machinery, erected for the Houses of Parliament, and also employed at the works of Messrs. Taylor, Williams, and Jordan, Belvidere Road. The author explained to the meeting the mechanism which forms the two floating tables, and which, by a universal motion, allows the vertical tracer and cutter to perform their work. A perfect pattern of the work to be carved is first modelled by the artist, and afterwards copied by the machine in wood with perfect accuracy, and in such a manner that two or three copies are made simultaneously. The Carving thus prepared by the machine is then sent back to the artist, who introduces by hand the finishing touches, and thus the works have the merits of artistic productions at comparatively small cost. The decorations of the House of Lords are the most extensive works yet done by this machine; but groups of flowers and ribbon-work, and sculpturing in the round, were exhibited, and covered the walls of the room.

A paper has also been read by Mr. Irvin, on his Patent Machinery for the Manufacture of Architectural Carvings. The author commenced by stating, that of late years the art of Carving has been allowed to decline on account of the expensive, tedious, and delicate process employed in the production of meritorious works in that branch of art. The revived taste of the present day,—the rapid improvements in science and art,—the increased passion for architectural embellishment,—the growing anxiety in the public mind to rescue from neglect or oblivion every relic of our ancient magnificence, sacred or civil,—the learned associations which have sprung up for the advancement of this grand object, had induced him to turn his attention to the subject; and he had perfected machinery by which he is enabled to multiply carved works to any extent, and produce them at one-fourth of their original cost. The secretary described to the meeting the nature of the machinery, which consists of a polar tool, that can be raised, depressed, or moved in a curved direction, at pleasure. The head of the machine, on which the work is placed, is also moveable; and thus the workman is enabled to trace from his drawing any given line, and produce a corresponding relief.

COMPOSITION ORNAMENTS.

The following process for making the Ornaments on looking-glass and picture frames is given in the *Scientific American*:—Dissolve one pound of glue in one gallon of water; in another kettle boil together two pounds of rosin, one gill of Venice turpentine, and one pint of linseed oil. Mix all together in one kettle, and continue the boiling, stirring them together till the water has evaporated from the other ingredients: then add finely pulverised whiting till the mass is brought to the consistence of soft putty. This composition will be hard when cold; but being warmed it may be moulded to any shape by carved stamps or prints; and the moulded figures

will soon become dry and hard, and will retain their shape and form more permanently than carvings on wood. They may be fastened with common glue on either plain surfaces or mouldings.

LIGHT AND COLOURS IN DECORATION.

A DISCUSSION lately took place, at a meeting of the Decorative Art Society, upon "the Influence of Light and Colours." The theory of three primary colours was questioned; it being assumed that yellow, red, and blue, are indeterminate gradations of intensity between light and its absence. In support of this argument, the red appearance of the sun when viewed through a fog, and the varying changes of colour according to the medium seen through, with other results of a like nature, were adduced. The phenomenon of an object which is placed within the range of two lights proceeding from the moon and a street gas-lamp, producing thereby two shadows of different colours, red and blue, was mentioned as being worthy of the consideration of artists, and as having reference to the above argument.

GIBSON'S STATUE OF THE QUEEN.

THIS beautiful Statue has been completed, and exhibited at the Royal Academy. It now graces the Royal Gallery at Buckingham Palace.

"This work," says the *Roman Advertiser*, "has become an object of much attention from the style in which the artist has completed its details, with the use of colour in the ornaments and embroidery of the dress. We need not dwell upon its beauties, except to say that its completion has enhanced those which, when in an unfinished state, were already so distinguished: and that in majestic gracefulness it not only raises the subject to its highest ideal without sacrificing truth of resemblance, but is a personification of the royal so obvious, that if discovered centuries hence, we believe there could be no hesitation in recognising it as the statue of a queen, even without the tiara, or any other insignia. We felt some alarm for its reputation, on learning that it had been coloured, and visited it again, doubtful of receiving an impression so agreeable as the first. But the application of colour is so delicate, the tone so subdued, that no effect of glaring contrast is produced, and the pale purity of the marble does not, as a whole, suffer from the partial tinting. Nothing more is coloured than the rim of the tiara and the dolphins that ornament its circlet, in yellow; the wave-formed embroidery of the robe, and the rose, shamrock, and thistle, at the corners, in red and blue; the acorns pendent from the extremities, where the Greeks wore weight of gold, in yellow." "The statue is one in which much detail is introduced, in which the effect sought is that of the majestic both from character and position. In such a one, where ornament is befitting, and richness, as far as suitable to sculpture, an attribute of propriety, the introduction of colour partially, and under the control of so refined a taste as this artist's, does not (speaking from our own impression) jar against principles, nor approach so near to the real as to prejudice the ideal of the subject. Though the detail is rich, it is softened almost to shadowiness, and not much nearer to the glare of dyed draperies, as actually worn, than the paleness of the marble to the warm hues of the flesh. It adds so much of the effect of

splendour to the figure as to enhance its abstract character, that of female royalty, rather than destroy its purity in general effect."

PRESENT STATE OF THE PARTHENON.

Mr. G. Knowles has published a plan of the Parthenon, on a scale of 50 feet to 3 inches, shewing its actual state with great minuteness, and particularly the ichnographic disposition of the columns of the interior not before given. In 1842, the Archæological Society of Athens removed the mosque which, during many years, had occupied the greater part of the cella of the Parthenon, and the internal arrangement of the columns became evident by unquestionable indications on the paving. "It appears," says Mr. Knowles, in a page of letterpress accompanying the plan, "that the axes of the columns were placed upon the joints of the slabs composing the pavement, precisely according to the system observed in the interior peristyle of the temple itself. It is conjectured that the angles were supported by pilasters, as well from the evidence of a corresponding one actually existing in the south-eastern end of the cella, as from the requirement of the intercolumniation: but it must be stated, that no distinct traces of such pilasters have been discovered."

The plan gives the measurement of every piece of the pavement remaining, and all "marks and indications upon the surface of the plan of the temple, which might, by possibility, assist the future investigation of these precious remains."—*The Builder*, No. 241.

DIMENSIONS OF EUROPEAN CHURCHES.

The *Roman Advertiser* gives the following statistics of the capabilities of St. Paul's, as compared with other great churches; allowing four persons to every quadrate meter (square yard):—

	Persons.	Sq. yds.
St. Peter's	54,000	13,500
Milan Cathedral	37,000	9,250
St. Paul's, at Rome	32,000	8,000
St. Paul's, at London	25,600	6,400
St. Petronio, at Bologna	24,400	6,100
Florence Cathedral	24,300	6,075
Antwerp Cathedral	24,000	6,000
St. Sophia's, at Constantinople	23,000	5,750
St. John, Lateran	22,900	5,725
Nôtre Dame, at Paris	21,000	5,250
Pisa Cathedral	13,000	5,250
St. Stephen's, at Vienna	12,400	3,100
St. Dominic's, at Bologna	12,000	3,000
St. Peter's, at Bologna	11,400	2,850
Cathedral of Siena	11,000	2,750
St. Mark's, Venice	7,000	1,750

The piazza of St. Peter's, in its widest limits, allowing 12 persons to the quadrate meter, holds 624,000; allowing four to the same, drawn up in military array, 208,000. In its narrow limits, not comprising the porticos or the piazza rusticci, 474,000 crowded, and 138,000 in military array, to the quadrate meter.

TO OBTAIN HEIGHTS WHICH CANNOT BE MEASURED.

Take any two rods of unequal length, place the short rod at any con-

venient distance from the building, and the long rod at such a distance from it, that looking over the short rod to the top of the building, the top of the long rod shall cut that sight. Then say, as the distance between the rods is to the height of the long rod over the short one, so is the distance of the long rod from the building to the height of the building, to which result add the short rod, and you have the height of the building. —*The Builder*, No. 23.

NOVELTIES IN GLASS.

THE relaxed tariff, as foretold by Sir Robert Peel, has led to the extended use of Glass, for a variety of implements and purposes to which it had not been previously applied.

Thus, it has been proposed to cover the key notes of the piano-forte with a tasteful irridescence of varicoloured glass; and it has been suggested that illuminative gas might advantageously be conducted through pipes of glass, with ground and closely fitting jointings.

Not only milk-pans, (yielding additional cream,) and cream-pots, jars, and flower-pots, tiles, grape-glasses, and various other horticultural and floricultural utensils, are already made of glass; but rolling-pins and various other articles hitherto made of wood, clay, or metal. We have also bee-glasses, and propagating-glasses, and seed protectors, made of glass; and glass balance-springs for chronometers have, for some years, been found to possess a greater degree of elasticity than steel, as well as a greater power of resisting the alternations of heat or cold.

A patent has been taken out by Mr. Parkes, of Peckham, Surrey, for making coffins of glass by a mould, or of thick plates of china joined together by a durable cement, or of wooden cases lined with plates of glass, united by a mixture of fused glass and borax.

A correspondent of *The Builder* suggests that Glass might be usefully substituted for metal to form the roof of verandahs, thus obviating the darkening of rooms which is caused by metal. For coal-plates, area gratings, or the covering of cellars, where much light is required, and the top is to be used as a yard or passage, thick, rough plate glass might be advantageously used; also, for the risers, and in some cases, even for the treads of stairs, where light is required in the basement, or to stairs underneath. For any of these purposes, if air as well as light were required, the glass might be perforated, as stout, rough plate-glass is very strong, and will bear a considerable weight.

Glass has often been recommended for conveying gas, water, and electric telegraph wires; the black bottle being best adapted for these appliances.

Glass pipes might also be used for house-drains and traps, bottoms of sewers, cisterns, meat-safes, larder-shelves, tables, side-boards, wash-hand stands, sinks, taps,; and, even for whole doors, where light is requisite.

[For several interesting illustrations of the manufacture of ancient glass by modern process, see Mr. Pellatt's paper on Ornamental Glass, *ante*, pp. 83, 84, 85.]

Natural Philosophy.

THE CAVENDISH EXPERIMENT.

A PAPER has been read to the Royal Society, "On the cause of the discrepancies observed by Mr. Baily with the Cavendish Apparatus for determining the Mean Density of the Earth," by George Whitehurst Hearn, Esq. of the Royal Military College, Sandhurst.

After taking a summary review of the methods employed by Mr. Baily,* the author, suspecting that the anomalies had their source in the variable magnetic states of the masses which were the subject of experiment, traces the effects which such an influence might be supposed to have on those results. He finds that, the attraction arising from gravitation between a mass and one of the balls being exceedingly minute, an almost inconceivably feeble magnetic state may be the cause of great perturbations. He then proceeds to investigate the subject by the application of mathematical analysis; from which he is led to the conclusion that the masses and balls do actually exert on one another influences which are independent of the action of gravitation. He finds that such influences are of a very fluctuating nature; the action arising from them being either positive or negative, and its sign also changing in each revolution as the masses are turned round a vertical axis; and he observes, that such action may either fall short of that arising from gravitation or exceed it many times. Such disturbing force he conceives can be no other than a magnetic influence; not, however, one of the ordinary kind, but that which Faraday has recently discovered as affecting all diamagnetic bodies.

The author concludes by proposing methods by which the inquiry should in future be conducted, so as to obviate or eliminate this source of error.

THE TIDES.

THE REV. MR. WHEWELL has delivered to the British Association, a Report of a Committee, consisting of himself and Capt. Sir J. C. Ross, appointed at Southampton to draw up a plan for a naval expedition for completing our knowledge of the progress of the Tides.† The knowledge which we possess of the tides, looking at the connexion of the phenomena over the whole surface of the ocean, is extremely imperfect at present, and not at all likely to be completed in any material degree in any finite

* An interesting *resumé* of Mr. Baily's labours, with a description of the Apparatus, will be found in the Year-book of Facts, 1839, p. 82.

† At the meeting of the Royal Society on Dec. 15, the Rev. W. Whewell delivered the Bakerian Lecture, entitled "Thirteenth Series of Tide Researches." Mr. Whewell stated, among other things, that he has collected materials for a Tide Map of the Pacific from various navigators:—Cook, Flinders, King, Captains Fitzroy, Sir E. Belcher, Sir James Ross, Stokes, Killet, and others of our own countrymen—Malaspina, Freycinet, Du Petit-Thouars, Wrangel and Admiral Lütke, and other Spanish, French, and Russian navigators. The result of these appears to be, that on the eastern coast of the Pacific the tide comes from the west—arrives first at the coast near Acapulca and Nicoya, and is later and later both to the north and to the south of this point—passing to the eastward round Cape Horn, as observed by King, and to the northward along the coast of North America, and then to the westward along the Aleontian Isles, and so to Kamtschatka, as stated by Admiral Lütke.

time, by the observations which voyagers mainly directed to other objects will supply. The coasts and islands which surround or break the waters of the Pacific, are especially the seats of this ignorance. We know the time of tide near Cape Horn, but cannot trace the progress of the tide waves along the western coast of South and North America. We know the time of tide on the coasts of New Zealand, but cannot connect this fact with the rise and fall of the water on the coasts of the smaller islands in the centre of the ocean. We know the tide hour on the eastern coast of New Holland, but cannot trace the progress of the tide to the Philippines or to the coast of China—though some observations of Admiral Lütke, made a few years ago, supply a valuable addition to our knowledge on this subject. The course of the tide wave among the islands of the Indian Sea is likewise unknown. Observations made by voyagers mainly guided by other purposes appear likely to supply this deficiency in our knowledge, for even when made with sufficient care and for several weeks at detached places, they are rarely connected with each other or neighbouring places. It does not, however, appear that while we are thus left to depend on chance for our tidal knowledge, we shall ever be able to know from observation whether the tide wave in the Pacific does or does not move from east to west. But a ship sent out on purpose to observe the tides could very soon ascertain a great body of facts of this kind. The observers would, of course, observe the facts of the tides in connexion with each other, and would arrange their plan of operations so as to extend their lines of connexion from known points to unknown. By such a mode of proceeding, the co-tidal lines for every part of the Pacific and Indian Oceans might probably be drawn (omitting the minor details in the interior of archipelagos, &c.) in a year—at most in two years. The tide observations made, at the request of Dr. Whewell, in 1834, for a fortnight by the coast guard on the coasts of Great Britain and Ireland, prove how great an accession our tidal knowledge may receive from connected observations; and still more those made in June 1835, for a fortnight, along the coasts of the whole of Europe and the eastern coast of the United States of North America. By means of these observations, the general course of the tides in the year thus explored has been determined. If an expedition were sent for the purpose of making tide observations, it would not be at all necessary to have, as in the instances just mentioned, simultaneous observations along the whole line of sea observed. It would suffice to connect a few places by corresponding observations, in some cases for a fortnight, in others for a few days; then, to connect one of these places with others, and thus to proceed through the whole region observed. It appears by the experience of the surveys which we have referred to, that the observations may be made by sailors, such as those employed on the coast guard, under proper directions. On those occasions the necessary apparatus was speedily constructed by the persons employed. It might, however, be useful also to employ, in several places, self-registering tide-gaugers such as are already established in several English ports. We conceive that the project contemplated by the Association in its recommendation is very desirable; and might best be attained by sending out a vessel which should have for the object of its voyage to make tide observations upon such a connected system. For this purpose, the vessel ought to carry, in addition to a crew sufficient to

work her, ten or fifteen men, who, by themselves (in pairs) or under the direction of petty officers, might be trusted to make tide observations for a week or a fortnight at selected points of coast. The surveying vessel ought to be provided with a launch to be employed in carrying these observers to their station, visiting them while engaged in their work, or fetching them away when their task at each place is done. From one region to another of the ocean, standard stations ought to be selected, at which tide observations should be continued for a longer time, and the observations made in each region should be compared with those at the standard station. The comparison of the observations with each other, as the survey proceeded, would point out the direction in which it was desirable to extend the survey, and the special points to be attended to. We, therefore, recommend that application be made to the Admiralty that they would appropriate to this service a suitable vessel.

Mr. Orlebar informed the meeting that he had, while at Bombay, conducted a regular series of observations on the progress of the tides; that similar observations had been made in other parts of India, and at Aden at the mouth of the Red Sea; and that the Geographical Society had seen the importance of those observations, and had lately turned their attention to them.—The Astronomer-Royal inquired at what intervals the observations at Bombay were taken?—Mr. Orlebar replied that they were taken by a tide gauge, and were, therefore, continuous.—The Astronomer-Royal said that frequency of taking the observations was most essential. Upon analyzing the observations he had lately superintended round the Irish coast, the extraordinary fact had been ascertained, that at some places four tides took place in the day; and the continuance of the waves of these tides could be distinctly traced to a considerable distance on each side south.—Mr. Orlebar said that nothing had been done in the way of analysis or reduction of the Bombay observations.—Dr. Whewell pointed out several peculiarities of the tides in the East Indies—particularly dwelling on those at Singapore. He also drew attention to the researches of Admiral Lütke, on the north coasts of America and in the Northern Ocean; and begged to ask Prof. Struve whether those were not still continued.—Prof. Struve replied that the researches of Lütke were still continued, particularly along the shores of the White Sea and various parts of the Northern Ocean; and believed he was almost the only navigator who had bestowed a large portion of attention on the determination of co-tidal lines.—*Athenæum*, No. 1027.

THEORY OF OSCILLATORY WAVES.

A PAPER on this subject has been communicated to the Cambridge Philosophical Society, by Mr. G. G. Stokes, M.A.

The waves which form the subject, are characterized by the property of being propagated with a constant velocity, and without degradation, or change of form of any kind. The principal object of the paper is to investigate the form of these waves, and their velocity of propagation, to a second approximation; the height of the waves being supposed small, but finite. It is shown that the elevated and depressed portions of the fluid are not similar, as is the case to a first approximation; but the hollows are broad and shallow, the elevations comparatively narrow and high. The velo-

city of propagation is the same as to a first approximation, and is therefore independent of the height of the waves. It is remarkable that the forward motion of the particles near the surface is not exactly compensated by their backward motion, as is the case to a first approximation; so that the fluid near the surface, in addition to its motion of oscillation, is flowing with a small velocity in the direction in which the waves are propagated, and this velocity admits of expression in terms of the length and height of the waves. The knowledge of this circumstance may be of some use in leading to a more correct estimate of the allowance to be made for leeway in the case of a ship at sea. The author has proceeded to a third approximation in the case in which the depth of the fluid is very great, and finds that the velocity of propagation is increased by a small quantity, which bears to the whole a ratio depending on the square of the ratio of the height of the waves to their length.

In the concluding part of the paper is given the velocity of propagation of a series of waves propagated along the common surface of two fluids, of which the upper is bounded by a horizontal rigid plane. There is also given the velocity of propagation of the above series, as well as that of the series propagated along the upper surface of the upper fluid, in the case in which the upper surface is free. In these investigations the squares of small quantities are omitted.

HEIGHT OF WAVES.

ALTHOUGH the south-westerly breeze of the preceding day hardly amounted to a moderate gale, we found that this morning we had run into a heavy swell from that direction. The result of several experiments gave only twenty-two feet for the entire height of the Waves, or eleven feet above and below the general level of the ocean; the velocity of the undulations eighty-nine miles per hour, and the interval between each wave nineteen hundred and ten feet.—*Sir James C. Ross' Voyage to the Southern Seas.*

ATMOSPHERIC PRESSURE UNDER DIFFERENT LATITUDES.

BAROMETRICAL experiments appear to prove that the Atmospheric Pressure is considerably less at the equator than near the tropics; and to the south of the tropic of Capricorn, where it is greatest, a gradual diminution occurs as the latitude is increased, as will be seen from the following table, derived from hourly observations of the height of the column of mercury, between the 20th of November 1839, and the 31st July 1843.

The mean pressure and the amount of atmospheric tide in each latitude are as follows:—

Lat.	Pressure.	Tide.	
At the Equator.	29°·974	0°·47	At Sea.
13°·0 S.	30·016	0·60	..
22·17	30·085	0·53	..
34·48	30·023	0·52	Cape of Good Hope and Sydney.
42·53	29·950	0·50	Van Diemen's Land.

45·0	26·664	0·31	At Sea.
49·8	29·469	0·40	Kerguelen and Auckland Islands.
51·33	29·497	0·32	Falkland Island.
54·26	29·347	0·22	At Sea.
55·52	29·306	0·27	Cape Horn.
60·0	29·114	0·24	At Sea.
66·0	29·078	0·16	..
74·0	28·928	0·16	..

The above results are arranged in belts of latitude, the observations at sea being separated from those made in harbour; this occasions more apparent irregularity than would have been the case had they been turned into two distinct tables.

It has hitherto been considered that the mean pressure of the atmosphere at the level of the sea was nearly the same in all parts of the world, as no material difference occurs between the equator and the highest northern latitudes. At Melville Island, in latitude 74¾°, it was found to be 29·870; at Igloolik, in latitude 69°, 29·770; and at Winter Island, in latitude 66° 11′, 29·798. The cause of the atmospheric pressure being so very much less in the southern than in the northern hemisphere, remains to be determined; and I trust that the very extensive series of observations made on board the Erebus and Terror, will be of material assistance in the important inquiry.—*Captain Sir James C. Ross' Voyage to the Southern Seas.*

GREAT BAROMETRIC DEPRESSION.

Mr. W. R. Birt writes to the *Athenæum*, No. 1050, dated from Bethnal-Green, December 7, 1847:—

"The storm which is now passing over us in connection with the low reading of the barometer is doubtless a matter of interest to most meteorologists. On the 1st, at 11 15 p.m. the altitnde of the barometer at this station was 30·397. Shortly after this reading a fall of the mercurial column commenced, which continued with one or two interruptions until early this morning; when at 5 35 a.m. the reading of my instrument was 28·573. Thus, in 5 days 6 hours 20 minutes the range was 1·824 inch. This *extraordinary* fall appears the more remarkable as on consulting the volumes of the Greenwich Observations 1840 to 1844 I find only one similar movement—in 1840. On December the 3rd, 8 p.m., the reading at the Observatory was 30·445—on the 8th at 8 a.m. it was 29·132 (the lowest of the month); range in 4 days 12 hours 1·313 inch. At this part of the month in the remaining years, the barometer has generally been *high*. The depression of this morning has been ·477 inch higher than the memorable depression of January the 13th, 1843. On that occasion, if I mistake not, the depression was *greater* towards the north-west:—and in soliciting the attention of meteorologists to the present low reading, I take this opportunity of suggesting that the barometric movements in Ireland, Scotland—and especially at the Orkney and the Western Isles—will be found full of interest in elucidating its phenomena as exhibited at different points of the earth's surface.

THE MAGNETIC EQUATOR.

Sir James C. Ross thus describes the approach of his late Expedi-

tion to the Magnetic Equator; the alteration in the dip of the needle being a point of importance.

"As we approached the magnetic equator, or line of no dip, our observations relative to this interesting question were more frequent; and in order to secure a faithful record of those of each ship, as well as to detect the cause of any differences in either, it became our practice every day at 1 P.M. to communicate by signal the results of all that had been obtained up to that time. So much advantage was derived from this measure, that I would strongly recommend its adoption by any expedition that may be employed on a service of this nature. We had watched the progressive diminution of the dip of the needle, and steering a course as nearly south as the wind permitted, in order to cross the line of no dip at right angles, we found the change so rapid as to be ascertained with great precision; so much so, that the signal for our being on the exact point of no dip, where the needles, being equally poised between the northern and southern magnetic systems, assumed a perfectly horizontal position, was being hoisted from both ships at the same instant of time. Nothing could be more satisfactory than the perfect accordance of our observations in a determination of so much importance: nor could it fail to be of more than ordinary interest to me to witness the needle thus affected; having some years previously, when at the north magnetic pole, seen it in a directly *vertical* position: nor was it unnatural, when we saw the south pole of the needle beginning to point below the horizon, to indulge the hope, that ere long we might be permitted again to see it in a similar position at the south magnetic pole of the earth. The regularity, as well as the rapidity, with which the alterations of dip occur, is also worthy of notice. At two hundred and eighty miles north of the magnetic equator, the dip was 9° 36′, showing about 2·05 minutes of change for every mile of latitude; at two hundred and ninety-two miles to the south, the dip was 9° 52′, or about 2·03 minutes for every mile of latitude. It is to be remembered that this large amount of change is limited to the region of the magnetic equator; near the poles, it requires an approach of about two miles to produce an alteration of a single minute of dip."

PERPETUAL MOTION.

In the year 1813, a belief in the delusive principle of Perpetual Motion was created throughout a considerable portion of the community of the United States, by a deceptive machine, constructed by one Redhœffer, and which had gained sufficient character to induce an inquiry into its reality by the appointment of a committee of the legislature of Pennsylvania. The attention of Mr. Lukens was turned to the subject, and although the actual moving cause was not discovered, yet the deception was so ingeniously imitated in a machine of similar appearance made by him, and moved by spring so well concealed, that the deceiver was himself deceived; and Redhœffer was induced to believe that Mr. Lukens had been successful in obtaining a moving power in some way in which he himself had failed, when he had produced a machine so plausible in appearance as to deceive the public.—*Franklin Journal.*

COMPASSES IN IRON-BUILT VESSELS.

Dr. Scoresby has communicated to the British Association, a paper "On the Defects of, and Danger arising from the use of, Corrective Magnets for local attraction on Compasses of Iron-built Vessels."

Dr. Scoresby said, that if Prof. Airy's mode of correction for local attraction was not true it must be dangerous. He asserted it was not true, and attributed the loss of many iron steamers to a delusive reliance on the compensated compass. He had conducted a series of experiments which proved that there was no such thing as permanent magnetism in malleable iron. The magnetism of malleable iron was exceedingly unstable; and must be especially so under the vibratory action of a steamer, the working of the engines, straining by the waves, &c. And hence a constantly varying source of error, not corrected by any mode of compensation yet proposed. Dr. Scoresby suggested the placing a compass on the mast-head. This would be beyond local influence, give the true direction, and therefore correction for the deck compasses.

Lieut.-Colonel Sabine entirely agreed with Dr. Scoresby in the necessity for caution, and stated that no compensated compasses were allowed in the Navy.

GREAT MAGNETIC DISTURBANCE.

In No. 209 of the *Philosophical Magazine*, we find the following letter from Captain J. H. Lefroy, R.A., Director of the Magnetic Observatory in Canada, to Lieutenant-Colonel Sabine, R.A., on a Great Magnetic Disturbance on the 24th of September, 1847:—

"This day has been distinguished by a greater disturbance than any we have had yet. The observed range of declination was $4^0\ 3'$; and I have little doubt that the actual range was greater, as the non-commissioned officer on duty, when he found that the movement was beyond the scale of the observatory declinometer, lost time in sending for me, instead of at once lighting the lamp of the transportable one, and following it up on that. The observed range of horizontal force was over 600 divisions, or 0·052 of the horizontal force! The day has been raw and cloudy, with occasional rain, so that if an aurora existed, it could not have been seen. The disturbance seems to have begun between 21^h and 22^q Gottingen time on the 23rd, as the observation at 22^h was decidedly unusual; but extra observations did not commence until $23^h\ 20^m$. The extreme disturbanee began about $0^h\ 35^m$ on the 24th, when both the large declinometer and large bifilar went off their scales. At this time I was called, and we began to observe the transportable declinometer and bifilar. The last also went off the scale. The lowest reading of the former was 692·5 at $1^h\ 0^m$ Gött., and the highest 1126·0 at $1^h\ 45^m$: this gives a range of $3°\ 36'\cdot7$; but at a subsequent period ($5^h\ 0^m$ Gött.) a reading of 1177·2 was obtained, thus giving the enormous range of $4°\ 2'\cdot3$.* I did not take a reading of your compass; but looking hastily at it, I perceived that during the great shock it was ranging more than $3°\ 20'$ from its usual position. As both bifilar scales were exceeded, we can only say that the range of that element between 0^h and 1^h Gött. exceeded 600 divisions, or

* I think our greatest range before this was only 2 deg. 23 min.; this occurred last April.

0·052 of its whole amount, on the testimony of two instruments; a fact which cannot, I think, but make it a most interesting question, what is the nature of a force subject to such immense variations, and how can they occur without affecting, or being affected, by the other physical agents in the globe? This disturbance was attended by a great degree of motion in the magnets, a peculiar mechanical agitation, which they only exhibit on rare occasions; it lasted, more or less, down to 12^h Gött. As the results have not been made up, I cannot state precisely the range of inclination, but perhaps may do so before I close this.

"After some little trouble, I think we have got Dr. Robinson's Anemometer into beautiful working order. If the principle on which the velocity is estimated is correct, as we must feel confident it must be, I think it has a great superiority over any other instrument of the kind yet invented. The facility and precision with which the velocity is measured, and the beautiful manner in which sudden changes are shown, together with the large scale on which directions are marked, make it a pleasure to use it, and make Osler's instrument look quite clumsy beside it; it is a most elegant instrument, and will give diurnal curves of velocity with a precision we have never attained before. I found, on careful examination, that Osler's anemometer, which has been up seven years, was much the worse for wear, and not in a condition to give a satisfactory comparison with the other; we have, therefore, with a good deal of difficulty, taken it down. I have put it into the hands of the engineer here, and he is to refit all the essential parts, particularly the shoulder and collar of the vane, which were worn, and made the vane unsteady: we shall then be able to compare pressures and velocities."

ON THE DIURNAL VARIATION OF THE MAGNETIC DECLINATION AT ST. HELENA.

It has long been known that the Diurnal Variation of the Magnetic Needle is in an opposite direction in the southern, to what it is in the northern hemisphere; and it was therefore proposed as a problem by Arago, Humboldt, and others, to determine whether there exists any intermediate line of stations on the earth where those diurnal variations disappear. The results recorded in the present paper are founded on observations made at St. Helena during the five consecutive years, from 1841 to 1845 inclusive; and also on similar observations made at Singapore, in the years 1841 and 1842; and show that at these stations, which are intermediate between the northern magnetic hemispheres, the diurnal variations still take place; but those peculiar to each hemisphere prevail at opposite seasons of the year, apparently in accordance with the position of the sun with relation to the earth's equator.

EFFECTS OF MAGNETISM, ETC., UPON THE DIMENSIONS OF IRON AND STEEL BARS.

Mr. J. P. Joule has communicated to the *Philosophical Magazine*, Nos. 199 and 201, a series of elaborate experiments to ascertain the above effects. We have only room to quote the more important conclusions:—

"Copper is the only non-ferruginous metal experimented on. In the

trials made with wires of this metal, pressure and tension were successively applied, and very powerful currents transmitted through the coil; but in no case could be detected the slightest alteration in their dimensions."

With respect to the probable cause of the remarkable facts pointed out, Mr. Joule observes, "the law of *elongation* naturally suggests the joint operation of the attractive and repulsive forces of the constituent particles of the magnet as the cause of that phenomenon. On the other hand, the fact that the *shortening effect* is proportional to the magnetic intensity of the bar multiplied by the current traversing the coil, seems to indicate that, in this case, the effect is produced by the attraction of the magnetic particles by the coil. But, then, it will be asked, why so remarkable an augmentation of the effect is produced by the increase of tension in the case of the soft iron bars? When we are able to answer this question in a satisfactory manner, we shall probably have a much more complete acquaintance with the real nature of magnetism than we at present possess.

"I have already, in the former part of this paper, described an experiment which indicated that no alteration in the *bulk* of a bar of soft iron could be produced by magnetizing it. I thought, however, that it would be interesting to confirm the fact by an observation of the alteration of the dimensions of the iron at right angles to the direction of its polarity. For this purpose I took a piece of drawn iron gas-piping one yard long, $\frac{3}{16}$ths of an inch in bore, and $\frac{2}{16}$ths of an inch in thickness. A piece of thick covered copper wire was inserted into this tube, and bent over the outside of it; the lower extremity of the iron tube being fixed, and the upper end being attached to the micrometrical apparatus described in the first section of this paper, each division of which corresponded to $\frac{1}{13852}$th of an inch. The table of results shows that the length of the tube was diminished in order to make up for the increase of its diameter, which, in this instance, was in the direction of the polarity. The quantity of the shortening effect, viz. 3·4, is, however, only one-third of that due to the maximum elongation of soft iron bars, as observed in the first section. This is, probably, owing to the grain of the iron being in cross directions with respect to the polarity in the two cases; and partly, perhaps, to the iron tube not being fully saturated with magnetism. The experiment is worth repeating, especially as it affords a means of studying the magnetic condition of closed magnetic circuits."

ON THE UNIVERSALITY OF MAGNETISM. BY DR. DE HALDAT.

THE question of the Universality of Magnetism, on which M. de Haldat presented a memoir to the Academy of Sciences in 1841, having given rise to some objections, has been subjected to new researches, in which the author has confirmed the fact,—that all bodies in small masses and of an elongated form are subject to the influence of the magnet when exposed to its action, both when they are made to oscillate between the opposite magnetic poles, and when they are suspended in the same situation by silk filaments whose torsion is employed to value the force which they have acquired. A desire to trace the proximate cause of these phenomena induced the author to ascertain whether these bodies possess, of them-

selves, the property of acquiring the magnetic state, or whether they owe this property to the presence of iron, as many philosophers have maintained.

We have not space to quote the details of this paper; but subjoin a few of the results.

Sixty substances deprived of iron by the usual means, and found to be chemically pure, were thus prepared, and subjected to magnetic action, after having received the elongated form which ensures the success of these experiments. Among these substances are the following, whose absolute purity must be theoretically admitted, and which has moreover been proved by experiment: distilled water in the state of ice, hyaline quartz of perfect transparency, the carbonate and muriate of ammonia obtained by the combination of their component principles in a state of vapour, the carbon of the smoke of oil-lamps or pure resins, sulphur washed with hydrochloric acid and repeatedly sublimed, camphor several times sublimed, gum, bees' wax, &c.; we may also add, gold obtained from deposit, silver reduced from the chloride, and copper precipitated by galvanism. Each of these substances was placed upon a sheet of very thin paper, previously purified and suspended by a double filament of silk, and submitted to the influence of the two poles of a horse-shoe iron magnet carrying twenty-five kilogrammes. With respect to their behaviour under the influence of this double power, they are divided into two classes, conformably to the observation of Dr. Faraday, previously recognised by M. Becquerel. One class was placed in the direction of the magnetic current, the other transversely to this current. There is, therefore, no substance absolutely neutral with regard to the property of acquiring the magnetic power; but whatever be the direction which it takes, this can always be ascertained, and the acquired power determined, even measured, by means of the parts of the apparatus which measures the torsion.

From general considerations, and from very minute facts stated in this memoir, and from numerous others for which there was no room, it results:—

1. That iron, though eminently magnetic, is not the only body which possesses this property.

2. That its tendency to acquire this state is dependent upon its purity, and varies with its combination.

3. Lastly, that the magnetic power acting upon all bodies, either giving them a direction parallel to the current or transverse to this current, the fluid, the magnetic agent, possesses, like all other imponderable fluids or agents, universality of influence in nature.—*From the Annales de Chimie et de Physique*, Jan. 1847; *Philosophical Magazine*, No. 202, *abridged*.

ON THE THEORETICAL VELOCITY OF SOUND. BY J. P. JOULE*.

The celebrated French mathematician De Laplace has, it is well k now pointed out that the heat evolved by the compression of air is the cause of the velocity of sound, according to the theory of Newton, being so much less than that actually observed. He has also given a formula by which the velocity may be determined when the ratio of the specific heat

* Communicated by the Author, to the Philosophical Magazine, No. 206.

of air at constant pressure to that at constant volume is known. The determination of the elevation of temperature in air by compression has, however, been hitherto attended with difficulty, and hence the theorism of De Laplace has never yet been fairly compared with experiment. I was, therefore, anxious to ascertain how far the mechanical equivalent of heat, as determined by my recent experiments on the friction of fluids, might be able to contribute to clear up this question.

The capacity of air at constant pressure, according to the experiments of De la Roche and Berard, is 0·2669. Consequently a quantity of heat capable of increasing the temperature of a lb. of water by 1°, will give 1° also to 3·7471bs. of air, while the air will be expanded $\frac{1}{491}$; an expansion in which a force equal to 200·7lbs. through a foot is expended in rising the atmosphere of the earth. The equivalent of a degree of heat per lb. of water, determined by the careful experiments brought before the British Association at Oxford, is 775lbs. through a foot. Hence 200·7lbs. through a foot is equal to 0°·259.

We see, therefore, that for every degree of heat employed by De la Roche and Berard in expanding and heating air, 0°·259 was occupied in producing the mechanical effect, leaving 0°·741 as that actually employed in raising the temperature of the air. Hence the actual specific heat (commonly called capacity at constant volume) is 0·2669 + 0·741 = 0·1977. Taking this as the specific heat of air and the equivalent 775, it follows that if a volume of air of 171·6 cubic inches be compressed to 170·6 cubic inches, it will be heated 1°, a quantity of heat which will occasion an increased pressure of $\frac{1}{491}$. So that the celerity of sound will be increased by this means in the subduplicate ratio of 491 to 661·6, or in the simple ratio of 2216 to 2572, which will bring it up from Newton's estimate of 943 to 1095 feet per ″, which is as near 1130, the actual velocity at 32°, as could be expected from the nature of the experiments on the specific heat of air, and fully confirms the theory of Laplace.

"A GOOD ROOM FOR HEARING IN."

Mr. J. Scott Russell, in examining one of the causes of bad qualities in the construction of a room, showed that in a large square room, of the usual form, the reflexion of the same sound was carried to the speaker's ear by different paths, and in different periods of time; the result of which was the confusion of successive sounds and syllables with each other—and so a prolific cause of indistinct hearing. It required another principle to afford the remedy of these evils, and that principle Mr. Russell believed was quite new. He might venture to call it the principle of the *non-reflexion* and lateral accumulation of the sound wave. It had originally been suggested to him by the observation of a similar phenomenon in the wave of the first order in water. This wave he considered to be the type of the *sound wave;* and on examination he had found experimental evidence of the same phenomenon in the latter wave. He had observed that at angles below 45° the sound wave was no longer completely reflected from the surface on which it impinged; and that when the obliquity of the wave to the surface was 60°, a phenomenon followed of total *non-reflexion*—and the wave continued merely

to roll along the surface in a direction parallel to it. This fact furnished a ready means to remedy the evils so often produced by the reflexions and echo and interference of sound in public buildings. Wherever it was possible to place flat or curved surfaces at such angles that the direction of the sound should be very oblique to the surface, it might be harmlessly disposed of, and prevented from injurious reflexion. This was exactly what the stalls of a choir, the side chapels of a cathedral, and the partitions of boxes in an opera-house, did so successfully for buildings of a large class. The same principles enabled him to explain the Whispering Gallery of St. Paul's (which is circular) and another equally celebrated, mentioned by Saunders, which is perfectly straight. The same principle also explained the conveyance of sound along the smooth surface of a lake and over the flat surface of a sandy desert:—as well as the extraordinary reverberation or accumulation of sound in some portions of a building. Another principle was that of the polarity of the human voice. Mr. Russell showed the rapid diminution of intensity of sound on both sides of the axis of the mouth; and that instead of extending in a circular wave round the head of the speaker, as had been supposed, the line of hearing distance was an elongated oval extending forwards from the mouth.

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NATIONAL MEASURES, WEIGHTS, AND MONEY.

Major-General Sir Charles Pasley has communicated to the British Association, a paper "On Simplifying and Improving our National Measures, Weights, and Money." After adverting to the proceedings and Reports of Parliamentary Committees, Royal Commissioners, &c., on Weights and Measures, from the year 1758 to the present time, the General submitted an abstract of his own plan, which he supported by the following considerations:—In the first place, a simplicity and precision will be given to measures of distance and area on the surface of the globe, of which our present standards afford no criterion. For example, nobody knows or can even guess how many rods or yards there are in a given number of statute miles, nor how many acres or square yards there are in a given number of square miles of our present measure; which can only be ascertained by very troublesome calculations: but in the new measure proposed, 173 miles would be known at once to be 173,000 fathoms, and 248 square miles to be equal to 248,000 imperial acres, and to 248,000,000 square fathoms. In like manner, though no one can even guess how many cubic feet a given number of gallons of our present standard measure of capacity are equal to, or *vice versâ*, this embarrassing uncertainty, and the necessity of very troublesome calculations in order to compare those two denominations together, will be avoided by establishing the cubic foot as the only standard both of solidity and of capacity. In all buildings and other works of architecture, engineering, &c., the necessity of computing artificers' and labourers' work, as well as materials, duodecimally, and in goods sold by weight the troublesome reduction of tons into cwts., quarters, and pounds; and *vice versâ*—and in all accounts the reduction of pounds sterling into shillings, pence, and farthings, and *vice versâ*, will also be avoided; which will be an immense saving of time, trouble, and risk of error. To conclude, he

asserts that after a very careful investigation of the history of our national weights and measures, from the time of Alfred to the present day, he has ascertained that with the exception of our lineal measure, none of our present standards are venerable from their antiquity, as might naturally be supposed by those who have not had the means of such investigation; they having, on the contrary, been subject to much greater changes than any which he now proposes: and all those changes having originated from accident, error, bad workmanship, or neglect,—with the exception of the establishment of the imperial gallon in 1824; which, strange to say, but no less true, was the first and only modification of our existing standards, adopted systematically as an improvement and with a view to the public benefit, in the course of 800 years. Such as they were, however, even the legal standards were disregarded in every part of the kingdom, where such an immense number of incongruous and discordant local measures and weights prevailed; differing in such an extraordinary manner from those standards and from each other, not only in every county but in every market, as rendered them a perfect chaos, and quite as unintelligible to the public generally as those of the ancient Egyptians or Babylonians could have been.—*Athenæum*, No. 1029.

NEW CALCULATING MACHINE.

The Rev. H. Moseley has communicated to the *Philosophical Magazine*, No. 200, the details of a Machine which he has proposed to determine mechanically the products, quotients, logarithms, squares, square roots, and other powers and roots of the natural numbers, by means of combinations of greater simplicity than have hitherto been applied to the purposes of mechanical calculation.

The *principle* of the machine consists in the main, of a cone and a screw. The application of the cone and the disc to various purposes of mechanical calculation has long been well known, and particularly by the ingenious applications made of the disc to dynamical admeasurement by MM. Poncelet and Morin.

The novelty of *this* instrument consists in the combination of the screw with the cone.

In this paper Mr. Moseley details the theory of the instrument, and concludes: "it will be observed that whilst it differs from other calculating machines, and claims to be superior to them in the simplicity of its combinations, it differs also, and is inferior to them in this respect, that the truth of its registrations is dependent on the mechanical accuracy of its construction.

"Those elements of the machine on the mechanical truth and adaptation of which its accuracy depends, are—1st, the screw, the convolutions of whose thread must be of geometrical uniformity; 2nd, the cone, whose surface must be of geometrical truth; and 3rd, the wheel, whose edge must have so intimate a contact *with*, and hold *upon*, the surface of the cone, as to partake accurately in its motion at every point which it traverses."

Mr. Moseley's experience in the use of a similar cone and wheel in a

steam indicator, constructed at the expense of the British Association of Science, has convinced him that the required accuracy is in this last respect attainable.

"In respect to the first-mentioned sources of error, it may be observed that there are no mechanical forms of greater simplicity than the *cone* and the screw, and, probably, none in respect to which greater truth of construction is attainable.

"Every such instrument must, however, have its error; its *amount* in respect to this instrument may be determined by an obvious method, and it is probable that it may in every case be corrected by a corresponding *adjustment*."

ALTITUDE AND AZIMUTH INSTRUMENT, RECENTLY ERECTED AT THE ROYAL OBSERVATORY, GREENWICH.

THE Royal Observatory, at Greenwich, was founded for the special purpose of making lunar observations, as aids to navigation, to enable persons at sea the better to determine the longitude. This object has been steadily kept in view from that time to the present, and the whole of the existing theories and tables of the moon are based entirely upon the observations which have been taken at Greenwich Observatory. Till the Astronomer Royal devised his Altitude and Azimuth Instrument these observations could be taken only whilst the moon was passing the meridian, so that she might be shining brightly for many hours, yet, if she were obscured by clouds during the few minutes she would be visible in the field of Telescopes fixed in the meridian, no observations could be taken; and thus, very many observations were lost. This was felt by the Astronomer Royal as a matter of so serious a nature that he has devised the above Instrument, which is found to have such a degree of solidity and steadiness that the moon can be observed in any part of the sky, and thus the important series of observations rendered more complete.

The following explanation of the different parts of this New Altitude and Azimuth Instrument, has been given by the Astronomer Royal:—

This instrument is supported on a three-rayed pier of brickwork, built on a separate foundation from the walls of the Dome, and having no connection with it from the ground. This pier is raised to within a small distance of the floor of the Dome, so as not to be touched by the joists of the floor, which are supported entirely by the wall of the Dome. The internal diameter of the Dome is about twelve feet, and the sides of the triangle, formed by joining the extremities of the rays of the piers, are each about eight feet. Upon the top of the three-rayed pier is planted an iron framework, consisting of three rays, connected at their extremities by three sides, welded in the same piece: this iron work thus forms a triangle, whose sides are about eight feet, and which has pieces radiating from the centre in the same piece of metal. Upon each side of this triangle is erected an iron triangle, attached by screw-bolts to its angles, and rising above its plane about eleven feet. The points forming the vertices of these three triangles correspond to the three angles of another horizontal triangle, attached to them, but lying in such a position that its angles correspond to the sides of the lower triangle. The sides of this upper triangle are in one piece. In another piece are the three rays drawn from the centre to the angles of the triangle: they rest in forks at its angles, the ends of the rays being cut with screw threads, so that they can,

by means of nuts, be drawn endways. At the centre, and welded in the same piece of metal, is the Y for the upper pivot of the azimuthal motion, into which Y the pivot is forced sideways by a piece of steel screwed upon it, whose spring insures perfect bearing.

On the centre of the rayed brick pier is planted a circular stone pier, three feet in diameter. In the top of this are inserted three solid metallic forks (one of which is seen in the drawing), which receive the ribs of the lower fixed circle. This circle is a strongly-ribbed frame of bell-metal, cast in one piece, three feet in diameter, and six inches deep, with a conical hole for the bearing of the lower azimuthal pivot, a racked ring for pinion-action, and a graduated ring at its circumference.

The lower part of the azimuthal frame consists of a strongly-ribbed flat of cast iron (the ribs being on its lower side, and three inches in depth), with a vertical pivot, having a hemispherical end to work in the conical hollow of the lower circle. The upper surface is planed. This basis carries the clamp-screw and the slow-motion pinion, and the four micrometer microscopes for reading the lower circle. These microscopes are cast in the same piece with the basis: they were bored out after being cast. The part of each microscope which sustains the pressure of the micrometer-screw is included in the same cast.

The two uprights consist of two semi-cylindrical pieces, with their upper and lower ends planed, each about four feet six inches in height, its breadth about twenty-one inches, and its depth ten and a-half inches. The semi-circular part is solid and strong: the flat side of the semi-cylinder is much weaker. One of these uprights carries four microscopes for reading the vertical circle, and blocks for supporting the levels transverse to the horizontal axis. Each also carries a bracket, on which the Y for the horizontal axis is fixed by one powerful screw, and blocks for the levels parallel to the axis. Each vertical, with the parts which have been mentioned, is cast in one piece. The vertical which does not carry the four microscopes, carries the circles in which the clamp-screw and slow-motion pinion act. The upper connection of the uprights is by a flat piece, nine inches broad in the middle, ribbed, and carrying the upper pivot.

Upon the upper connecting piece are two levels parallel to the horizontal axis, resting on blocks which are near to the outside extremities of the vertical pieces. Two additional levels, parallel to those just mentioned, are placed at the bottom of the vertical pieces.

Two levels transversal to these, and to the horizontal axis, are placed on the outside of the vertical which carries the four microscopes, resting on blocks attached as near as possible to these microscopes.

The part moveable in altitude may be described as a transit-circle of great solidity. It consists of a double cone (each one being widened to a flat at its base), with the telescope between the bases of the cones. One cone (carrying the graduated circle, its pivot, and the two ends of the telescope), is cast in one piece, and the rest in another piece. The axis of this part is horizontal: its pivots rest upon the two Y's carried by the brackets which are cast on the two upright sides. On the side opposite the graduated circle, and near to the eye-end of the telescope, are the clamp-screw and the head of the pinion for slow motion. The diameter of the graduated circle is three feet. The length of the Telescope is about four feet.

The Telescope has in its field six horizontal and six vertical wires.

Friction wheels are placed beneath the ends of the horizontal axis. The circular form of these pivots has been most severely examined by micrometer microscopes, which are placed opposite to their ends, and are made to observe two rectangular co-ordinates of the motion of a dot on the pivot, at small angular intervals, during a revolution of the vertical circle. The piece (screwed to the uprights) which carries one of these microscopes is exhibited in the drawing.

By means of combinations of plane reflectors, the light of a large Argand lamp, supported by one of the uprights, is made to illuminate the fields of all the microscopes which read the two circles, while it directly illuminates the field of the telescope. A light-moderating apparatus is used for diminishing the intensity of the light in the field of the telescope, when it is found to be necessary.

The principal points which have been aimed at in the construction of this nstrument are the following—First, to construct it in as few pieces as possible; all the important parts being united as far as possible in the same casts of metal; in this respect it is remarkably different from the instruments made in late years by English artists. Secondly, to make no union of important parts by small screws. Thirdly, to leave no adjustments to be made by adjusting screws; the adjustments being effected as nearly as possible by filing, and the observations being so arranged that the remaining errors can be determined from the observations themselves. In a word, *firmness* is the object to which every part of the construction is directed.

An instrument thus constructed is necessarily ponderous. The weight of the moving parts of this instrument exceeds three-fourths of a ton. But its motion is perfectly easy.

It is impossible for us here to enter upon all the technicalities of the astronomical use of such an instrument. It will be sufficient to state that if the azimuths both of a high star and of a low star be observed in both positions of the instrument (that is, with the graduated face of the vertical circle Right and Left), and if the altitude of any one star be also observed in both positions (the sidereal time being always observed), then every error of adjustment can be determined, and every observation of the moon or a planet can be made perfectly available.

In the drawing are seen the steps used for ascending to the upper part of the instrument. These steps run on wheels freely around the pier, being attached to it by a ring of iron fastened to them, and which encircles the pier. They are stopped in any required position by a brake, of which the handle is seen in the drawing.

The upper or rotating part of the Dome is drum-shaped, and moves on cannon-balls. It turns with so great facility that it has been found necessary to attach to the bar used for giving it motion, a racked bar, which can be fastened to studs placed at intervals round the interior of the Dome.

The levers are also exhibited, by which the vertical and horizontal shutters to the Dome are opened and closed.

The instrument has now been in use for some time, and seems fully to answer the design of its erection, in giving observed places of the moon or other bodies when at a distance from the meridian, comparable in accuracy with those deduced from observations made with meridian instruments of the best class.

A remarkably fine and large engraving of this new Instrument,* drawn by permission of the Astronomer Royal, is given in the *Illustrated London News*, No. 288; in which Journal the accompanying details originally appeared.

THE ROSSE TELESCOPE.

THE capacity of this instrument is wonderful. Such is its power that if a star of the first magnitude were removed to such a distance that its light would be three millions of years in reaching us, this telescope would, nevertheless, show it to the human eye. Is it to be wondered at, then, that with such an instrument grand discoveries should be made? It has been pointed to the heavens; and, although in the beginning only of its career, it has already accomplished mighty things. There are nebulous spots in the heavens which have baffled all the instruments hitherto constructed, but this telescope resolves their true character completely. Among the wonderful objects which have been subject to its scrutiny, is the nebula in the constellation Orion. I have had an opportunity to examine it. It is one of the most curious objects in the whole heavens. It is not round, and it throws off furious lights. From the time of Herschel it has

* Drawn and engraved by Hare and Son.

been subjected to the examination of the most powerful instruments—but it grew more and more mysterious and diverse in its character. When Lord Rosse's great telescope was directed to its examination, it for a long time resisted its power. He found it required patient examination—night after night and month after month. At length a pure atmosphere gave him the resolution of its constitution; and the stars of which it is composed burst upon the sight of man for the first time.—*Mechanics' Mag.*

NEW PHENOMENA OF LIGHT.

Sir David Brewster has made to the British Association, the following four communications on Light.

On the diffraction bands produced by the edges of thin plates, whether solid or fluid; 2. on the dark lines in the red space beyond the red termination of Fraunhofer's spectrum; 3. on the functions of the parts of the membranes corresponding with the foramen centrale of Sömmering;—and 4. on the conversion of relief in a drawing by inverting the drawing seen by a lens.

1. Sir D. Brewster reiterated his assertion that the diffraction bands produced by the edges of thin plates were still unexplained, notwithstanding Mr. Whewell maintains that the undulatory theory affords a complete explanation. New experiments were described, which furnish new means of observing the phenomena; and more favourably, viz., the using of oil of cassia as a superior refracting medium; and a minute revolving rhomb of calcareous spar, by means of which the fringes are seen at any point of the spectrum. By the new experiments, Sir D. Brewster thinks he can account for the phenomena.

2. With the Munich prism, Sir D. Brewster has observed thirteen lines nearly parallel, and many others, beyond the red end of the spectrum as ordinarily seen. Many were visible one day, and not another; some in the morning, and not in the evening; and he had examined them with every care for perfect vision. Mr. Hunt asked how far below the red extreme he had traced colour? Sir D. Brewster: About one-sixth.

3. This communication had reference to the question whether the retina or the choroid coat be the seat of vision. It appeared to be Sir D. Brewster's opinion that the choroid is the seat of vision, and that upon it distinctness of vision depends; but that both choroid and retina are necessary to perfect vision.

4. The effects of inversion of a picture, namely, the elevated parts rising and the deep parts sinking, disappear when viewed through a magnifying glass of an inch focus.—*Literary Gazette*, No. 1528.

NEW THEORY OF THE POLARIZATION OF LIGHT. BY PROF. CHALLIS.

In this theory, *ether* is regarded as a continuous fluid substance, and is treated mathematically on hydrodynamical principles. By means of a new general equation in hydrodynamics, which the author has discovered, he shows that a filament of the fluid may continue in agitation, without lateral spreading; and that motion may be propagated along it uniformly, provided the motion consist of vibrations partly longitudinal and partly transversal, following the law of sines. Such a filament in motion is

supposed to correspond to a ray of light. The sensation of light is due to the *transverse* vibrations. In a ray of common light, the transverse motion is in planes passing through the axis of the ray, and is alike in all directions from the axis; in a plane-polarized ray, the transverse motion is in plane not passing through the axis; and in an elliptically polarized ray, the transverse vibrations are elliptical. Prof. Challis has extended his theory to the phenomena of double refraction, by a method which involves a new theory of the *dispersion* of light. He finds the surface of elasticity to be that of an ellipsoid; which is not in accordance with Fresnel's theory of double refraction. The equation of the wave-surface is, however, the same as in Fresnel's theory.—*Proceedings of the British Association*; *Athenæum*, No. 1023.

ON THE DEPOLARIZATION OF LIGHT. BY DR. DOVE.

If rectilinearly polarized Light be allowed to fall upon a rough surface, as a white wall, it is perfectly depolarized. This phenomenon is most distinctly seen, by allowing the spectra of a prism of rock-crystal, polarized at right angles to each other, to fall upon such a surface, and analysing the purple-red resulting from the violet end overlapping the red extremity, with a Nichol's prism. On rotating the latter, there is not the slightest alteration in colour. This depolarization, which eight years ago the author, in a paper communicated to the Berlin Society of Friends of Natural History, showed also to occur on the rough internal surface of bodies covered with a reflecting layer, progressively diminishes with the obliquity of the incidence, so that even the dullest surface ceases to depolarize at very acute incidences. With perpendicular incidence, it also extends to circular and elliptical light, which, when reflected by a rough surface, is depolarized, *i. e.* possesses the properties of common light. If the explanation of the depolarizing property of rough surfaces is found in the supposition that such a surface reflects in all directions, by the converse, the combination of light polarized in all possible planes yields common light by reflection. A truncated hollow cone, the smaller circular section of which was about fourteen lines in diameter, and the larger seventeen lines, was ground into a glass plate, four lines in thickness, and three inches in diameter. The lowermost surfaces of the glass were roughened at the margin of the circular section and blackened, and the larger circular section was covered with a glass plate, upon which a circular piece of tin-foil was pasted, so that its centre coincided with the axis of the truncated cone. The angle of the cone at the apex amounted to 70° 50′. When this apparatus is turned towards the sun, so that the rays fall at right angles to the base of the cone, they enter the annular space between the tin-foil and the dark coating of the sheath, and arrive at the reflecting surface of the hollow cone at an angle of 35° 25′, thus becoming polarized in all the planes of reflexion, and after reflexion, crossing at one point of the axis. In the apparatus made by Œrtling, this point was exactly in the plane of the smaller aperture of the cone, and was visible when received upon the surface of a piece of white paper placed there. As the polarized light would be depolarized on account of the depolarizing action of this rough surface, it could only be determined that it was unpolarized.

This was effected by polarizing the light incident upon the cone by means of an inserted glass-plate, and introducing a plate of mica between the inserted glass-plate and the cone. The point remained colourless.—*Philosophical Magazine*, No. 204.

APPLICATION OF POLARIZED LIGHT TO THE MICROSCOPE.

Mr. Legg has read to the Microscopical Society, a paper on this process, for which he has devised a series of Polarizing Apparatus, which may be readily adapted to almost any Microscope. It consists, first, of a bundle of plates of crown glass, from which the light is to be reflected at an angle of 56°, in which position one portion only of the light is refracted and another transmitted; each of which portions consists of light polarized in opposite planes. This arrangement is the best adapted to two single powers. 2nd. A plate of tourmaline as free from colour as possible, and cut parallel to the crystalline axis; and 3rd. A Nichols or single-image prism, being a portion of a crystal of Iceland spar, cut and combined with a piece of glass, so as to throw out of the field of view one of the two images produced by the double refraction of the crystal. This he described as being the most eligible for the compound microscope; inasmuch as it is perfectly free from colour, and requires very little adjustment. He described a series of experiments illustrating the most striking phenomena of double refraction; in which he employed the Nichols prism adapted under the stage, a double refractor to the eye-piece, a film of selenite of uniform thickness placed in accordance with its crystalline axis, and a plate of brass perforated with holes from about one-sixteenth to one quarter of an inch in diameter. In the first of these experiments, in which the double refracting crystal was placed over the eye-piece, two distinct images appeared; one of which revolved round the other, when the eye-piece was turned round, thus showing the ordinary and extraordinary rays. In the second, the Nichols prism was applied under the stage, the other arrangements remaining the same. Upon turning the eye-piece, although two images are produced, but one is seen when half the revolution is performed, *i. e.* at 180 degrees from the first position. Changes, also, take place at every other quadrant. In the third experiment, the selenite plate was interposed; the images were now coloured, and presented the complementary colours at every quarter of a circle. When the hole in the piece of brass was of a large size, the images were seen to overlap, and white light was produced.

MAGIC MIRRORS.

A paper has been read to the Academy of Sciences, at Paris, by M. Stanislaus Julien, on the Metallic Mirrors made in China, and to which the name of "Magic Mirrors" has been given. Hitherto, all attempts by Europeans to obtain information as to the process, in the localities where they are manufactured, have proved failures; some of the persons applied to being unwilling to reveal the secret, and others being ignorant of the process. These mirrors are called magical, because if they receive the rays of the sun on their polished surface, the characters, or flowers *in relief*, which exist on the other side, are faithfully reproduced. The fol-

lowing information has been obtained by M. Julien, from the writings of an author named Ou-tseu-hing, who lived between 1260 and 1341:—"The cause of this phenomenon is the distinct use of fine copper and rough copper. If, on the under side, there be produced, by casting in a mould, the figure of a dragon in a circle, there is then engraved deeply on the disc a dragon exactly similar. Then, the parts which have been cut are filled with rather rough copper; and this is, by the action of fire, incorporated with the other metal, which is of a finer nature. The face of the mirror is next prepared, and a slight coating of tin is spread over it. If the polished disc of a mirror so prepared be turned towards the sun, and the image be reflected on a wall, it presents distinctly the clear portion and the dark portion, the one of the fine and the other of the rough copper." Ou-tseu-hing states that he had ascertained this by a careful inspection of the fragments of a broken mirror.—*Mechanics' Magazine*, No. 1247.

PRODUCTION OF LIGHT BY HEAT.

Prof. Draper has communicated to the *Philosophical Magazine*, No. 202, a critical investigation of the phenomenon of the Production of Light by Solid Bodies, when their temperature is raised to a certain degree. The Professor first notices the diversity of opinion that has prevailed respecting some of the leading facts. Thus, Sir Isaac Newton fixed the temperature at which bodies become self-luminous at 635 degrees, Sir Humphry Davy at 812 degrees, Mr. Wedgwood at 947, and Mr. Daniell at 980 degrees. As respects the nature of the light emitted, there are similar contradictions. In some philosophical works of considerable repute, it is stated that when a solid begins to shine, it first emits red and then white rays; in others it is asserted that a mixture of blue and red light is the first that appears.

Prof. Draper has succeded in escaping or overcoming many of the difficulties of this problem, and has arrived at satisfactory solutions of main points; and as the experiments now to be described lead to some striking, and perhaps unexpected, analogies between light and heat, they commend themselves to our attention as having a bearing on the question of the identity of those imponderable principles. The following are the points treated of:—

1. To determine the point of incandescence of platinum, and to prove that different bodies become red-hot at the same temperature.

2. To determine the colour of the rays emitted by self-luminous bodies at different temperatures. This is done by the only reliable method—analysis by the prism.

From these experiments it will appear, that as the temperature rises the light increases in refrangibility; and making a due allowance for the physiological imperfection of the eye, the true order of the colours is red, orange, yellow, green, blue, indigo, violet.

3. To determine the relation between the brilliancy of the light emitted by a shining body and its temperature.

Here we shall find that the intensity of the light increases far more

rapidly than the temperature. For example, platinum at 2600 degrees emits almost forty times as much light as it does at 1900 degrees.

We must refer the reader to the *Philosophical Magazine* for the details of the investigation.

UNIT LAMP.

At the close of the paper just quoted, Prof. Draper remarks :—

"Among writers on optics, it has been a desideratum to obtain an artificial light of standard brilliancy. The preceding experiments furnish an easy means of supplying that want, and give us what might be termed a 'Unit Lamp.' A surface of platinum of standard dimensions, raised to a standard temperature by a voltaic current, will always emit a constant light. A strip of that metal, one inch long, and one-twentieth of an inch wide, connected with a lever by which its expansion might be measured, would yield at 2000 degrees a light suitable for most purposes. Moreover, it would be very easy to form from it an available photometer, by screening portions of the shining surface. An ingenious artist would have very little difficulty, by taking advantage of the movements of the lever, in making a self-acting apparatus, in which the platinum should be maintained at a uniform temperature, notwithstanding any change taking place in the voltaic current."

ANALOGY OF LIGHT AND HEAT.

Professor Henry, of Princeton, has communicated to the American Association of Geologists, an interesting investigation, showing the Analogy between Light and Heat. The experiments were made with a thermo-electrical apparatus, a very delicate instrument, which will indicate 1-500th of a degree of a Fahrenheit thermometer. It has been long known that two rays of light may be so thrown on each other as to produce darkness. Professor Henry showed that two rays of heat might be so combined as to produce cold. Light and heat differ with respect to the length of the waves—those of the latter are longer than those of the former. Experiments were made upon flames. Some flames give little light, but intense heat; as, for instance, the flame of hydrogen gas. If a solid body is plunged into such a flame, the radiant heat will be increased as well as the radiant light. Experiments made upon the spots of the sun showed that they were colder than the surrounding parts; also that the surface of that body is variously heated. The apparatus was applied to form a thermal-telescope :—when turned to the heavens, the coldest part was found to be directly overhead. Thunder clouds, sending forth flashes of lightning, were found to be colder than the surrounding clouds. When turned to the moon, there were some slight traces of heat, but those were proved to be from the reflected heat of the sun. He showed this to be the case by an experiment he performed on ice. In this experiment, the ice reflected heat. It has long been known that a burning lens could be made of ice.—*Boston Journal.*

WARMING WITH ICE.

In common language, anything is understood to be cooled or warmed,

when the temperature thereof is made higher or lower, whatever may have been the temperature when the change was commenced. Thus, it is said that melted iron is *cooled* down to a sub-red heat; or mercury is cooled from the freezing point to zero, or far below. By the same rule, solid mercury, say fifty degrees below zero, may, in any climate or temperature of the atmosphere, be immediately warmed and melted by being embedded in a cake of ice.—*Scientific American.*

MECHANICAL EQUIVALENT OF HEAT.

MR. J. P. JOULE explained to the British Association, at their late Meeting, that four years ago he had stated, that the Heat required to raise one pound of water one degree, was equal to a force necessary to raise 832 pounds one foot. He had since tested this experimentally, and he exhibited an apparatus by which he could keep water in motion for any length of time, and by which motion the temperature of the fluid became elevated. He had detected this increase of heat in water to three-fourths of a degree; the equivalent for which he found to be $775\frac{4}{10}$ lbs. Sperm oil gave the same results, though greater in effect. The like equivalent for oil was $775\frac{9}{10}$ lbs. This almost exactness, and other tests, convinced him that he had expounded the Mechanical Equivalent of Heat.—*Literary Gazette*, No. 1588.

HEAT AND EVAPORATION.

A COMMUNICATION has been made to the Academy of Sciences, at Paris, from M. Daubrée, containing a calculation of the quantity of Heat annually applied to the Evaporation of the water on the surface of the globe, and of the dynamic force of the streams of continents. He finds that the evaporation employs a quantity of heat about equal to one-third of what is received from the sun, or in other words equal to the melting of a bed of ice of nearly thirty-five feet in thickness if spread over the globe. The motive force of the streams in Europe is, according to M. Daubrée, equal to between 273,508,974 and 364,678,620 horses working incessantly during the whole period of the year.

CENTRAL FIRE IN THE EARTH.

THE increased temperature, found at increased depths in digging the Artesian wells, more particularly that of Grenelle in France, has been adduced by M. Arago, and other philosophers, as proof of Central Fire in the Earth. Commander C. Morton, of the Royal Navy, known as the propounder of the "*electrical origin of hail-stones*," and the vegetable origin of the basaltic columns of the Giant's Causeway, and those of Staffa, merely regards the increased temperature at increased depths as the natural consequence of the increased pressure of the atmosphere, and as much a matter of course as the increased cold or diminished temperature found to exist on ascending mountains, according as the atmospheric pressure diminishes in the ascent. The beautiful simplicity of this theory may, perhaps, induce the conviction of its alliance with nature. In corroboration, we may justly remark that the artificial compression of air does elicit heat.—*Literary Gazette*, No. 1572.

SUBTERRANEAN TEMPERATURE.

Prof. Forbes has communicated to the British Association, an account of Mr. Caldecott's Observations for three years, on the Temperature of the Earth in India.

The following conclusions are plainly deducible :—

1. The temperature of the ground at Trevandrum is from 5° to 6° Fahr. *higher* than that of the air. This result is confirmed by observations on the temperature of springs and wells at Trevandrum, which had been obligingly communicated to Prof. Forbes by Major-General Cullen of the Madras Artillery.

2. When the monthly means of the thermometers are projected, so as to show the curves of annual temperature, they are found to have one great inflection and a smaller one. The principal maximum of the temperature of the air occurs about the beginning of April, after which the rainy season sets in, and the annual curve goes through its extreme range in three months; the principal minimum occurring about the middle of July. The remaining fluctuations are comparatively insignificant, but indicate a slight maximum about the middle of October.

3. The epochs of temperature are retarded with the depth below the surface in the usual manner, and, at the same time, casual fluctuations disappear, and the ranges diminish. At twelve French feet, the principal maximum occurs five weeks later than in the open air, and the range is still at least a degree and a half.

From these facts it is easy to infer that the phenomena of the propagation of heat into the ground near the equator resemble those of temperate latitudes, though modified in extent and character. Mr. Caldecott's experiments conclusively establish (as he himself has pointed out) the error of the doctrine of Boussingault (at least for the eastern hemisphere), that the annual temperature near the equator remains unchanged at the depth of a foot below the surface in the shade. This mistake it is the more important to correct, because M. Poisson has attempted to confirm his mathematical theories of heat by applying them to this alleged fact.*

Mr. Caldecott's experiments appear further to prove a considerable excess of the temperature of the earth above that of the air at Trevandrum. This result is in opposition to the opinion of Kupffer, which supposes the earth temperature to be *less* than that of the air between the tropics, and that of Boussingault, who supposes them to be the same. The results of Mr. Caldecott are confirmed in both particulars by Captain Newbold of the Madras Army, in a late paper in the *Philosophical Transactions*.†

HIGH TEMPERATURE IN THE UNITED MINES. BY ROBERT WARE FOX.

The Temperature in some of the deeper parts of the United Mines has long been observed to be remarkably high ; and it has greatly increased with the increasing depth of the excavations.

Captain Youren, one of the agents of the mine,‡ informs me that near the eastern extremity of the deepest level, on the "*middle lode*," there is a spring or jet of water, discharging about 94 gallons a minute, at the temperature of

* Théorie de la Chaleur, p. 508. † For 1845, p. 125.

‡ This mine (for it is one concern) continues to produce abundance of cop-

106½° Fahrenheit.* This level is about 250 fathoms below the surface, and about 200 fathoms under the level of the sea. The "lode" has an underlie or dip of about 2½ feet in a fathom towards the north, and the water flows from its *northern or upper wall;* whilst from the opposite side, or *southern wall* of the lode, at the distance of only 3½ feet, there is another spring, discharging 30 gallons of water in a minute, at the temperature of 97½° Fahr. The air near both these springs was found to be at 104½° Fahr.: and "*killas*" is the only rock which has been seen within 30 fathoms of them. Granite occurs at a considerable distance westward of the place; and two "elvan courses" traverse the mine in nearly the same east and west direction as the lode.

I have found that ¼ of a pint of the water from the warmer spring contained 15 grains of saline matter, consisting of muriate of lime and common salt, in about equal proportions, with a trace of sulphuric acid, probably combined with lime. In the same quantity of the cooler water, only 10½ grains of muriate of lime and common salt were found, the latter in less proportion than the former; and in this water also there was a slight trace of sulphuric acid. In both instances, the water was clear, saline to the taste, and without any metallic salt.

It may, I think, be inferred from the saline contents of these springs, that they have a common origin or source; whilst their high temperatures indicate their having come from a considerable depth, and the quantity of water they discharge, that the lode, or rocks beneath, must be very pervious to it. In these instances, at least, there are no grounds for supposing that any chemical decomposition of the sulphur ores in the lode has caused the high temperature of the water, or contributed to it in any degree, seeing that it contains no metallic, and scarcely any sulphate salt.

The difference in the heat of the two springs may perhaps, in part, be attributed to the tendency of the warmer currents to rise towards the upper wall of the lode; and still more to that of water at a much lower temperature passing from superior strata down upon the inclined surface of the lower wall, where, mixing with the water rising from below, the temperature becomes modified, as well as the proportion of the saline contents.

It cannot be doubted that ascending and descending currents of water, more or less copious and at different degrees of temperature, abound in the veins and fissures of the earth, and often at the junctions of different rocks, and that they must have a great influence in modifying the subterranean temperature, and in different degrees in different places.

Common salt is of rare occurrence in our mines; its presence in the water in question cannot well be attributed to the flowing of sea-water into the excavation, in consequence of its local or direct pressure; for if some miles of distance from the coast did not render this highly improbable, the considerable streams at very high temperatures, and very constant too (as appears from observations made at different times), are facts not consistent with such an explanation. If the subterranean jets of water were caused by the inroads of a neighbouring sea, we should expect to find them at comparatively low temperatures, and these diminishing in proportion to the duration and amount of the influx.

The salt may, however, have been derived from the ocean, in consequence of the latter penetrating into the earth at its greater depths, or even at its lesser ones, which under different given circumstances, it may be supposed to do. In either case, the salt water would, from its superior specific gravity, have a tendency to descend through the heated and less saline water in the veins, fissures, &c., where the fluids becoming gradually more or less mixed and extended in different directions, might ultimately appear in some of our mines, brought up, perhaps, in the largest proportions, by the upward tendency of the more heated currents of water.—*The Fourteenth Annual Report of the Royal Cornwall Polytechnic Society*, 1847.

per ore. It is situated in the parish of Gwennap, about 8 miles to the northward, or almost NNW. of Falmeuth, and is several miles from the sea.

* The thermometer employed has been carefully compared with a standard one, and found to be ¼ of a degree too high; so that this small amount must be deducted from the results, making them 106·08°, 97·5°, and 104°, respectively.

Captain W. Francis has communicated to the Report of the above Society, for 1846, some interesting facts which have come under his notice, relative to the temperature of water in our mines, especially in reference to the great difference in the heat of water issuing from different parts of the same level; remarkable instances of which are now observed in the United Mines. To these Captain Francis adds the following observations relative to the source of the heat itself:—

It is a commonly received notion that the highest degrees of temperature are indications of large bodies of ores being contiguous, if not actually open to sight; but at the United Mines, and in others also, the lodes in those levels where the heat is greatest, are almost without ores, and both the lodes and the rock about them are hard and very compact. At the same time I admit, that such lodes have been found, somewhere, to contain large quantities of copper ore; but my object in making the preceding remark is rather to shew that the presence of great heat is not to be considered an infallible indication of large masses of ores being near at hand.

It should also be observed, that those lodes which yield the most copper ores generally hold considerable quantities of other minerals, such as iron-pyrites, arsenic, &c.; and it becomes a question, whether these may not account for much, if not the whole, of the heat in the mines.

That most of the lodes, and especially those which have yielded large quantities of copper ores, have, at some period, been under the influence of great heat, there can be no doubt, and to such an extent as to fuse their contents; and I see no reason for believing otherwise than that intense heat still exists in them at a distance from where they have been penetrated: but it should be remembered that the symptoms indicating the action of heat are not so frequent or strong in the deepest parts of those mines which have been worked to the greatest depths, as they are at higher levels, and especially near the surface, where gosson, at the depth of a few fathoms, or even a few feet, usually exhibit this fact in the clearest manner. I have had numerous opportunities of witnessing the fact just named in the deep mines in the Gwennap district, and in almost every case the lodes at the lowest points are composed of hard compact quartz, almost free from the presence of minerals, and yet the water issuing from those parts is of the highest temperature, which certainly strengthens the opinion that the source of heat is from a still greater depth; and its effects not being so evident in those places may be accounted for by the absence of those substances in the lodes on which the action of heat would manifest itself. But whilst it is admitted that the temperature increases with the depth, it should be observed, that it is not found to be the same at the same depth, even in parts of the same mine which are only a few fathoms' distance from each other. In different mines in the same locality, and in precisely similar formations, the result is often very different. As instances of this, I will refer to the Consolidated Mines, which adjoin the United Mines, and the lodes in each bear the same direction, and run parallel to each other. The former have been worked to the depth of 316 fathoms from the surface, whereas the latter have only been worked 260 fathoms, or 56 fathoms less than the first. The highest temperature in the Consolidated Mines has been 98° Fahrenheit, whilst in the United Mines it is 106°. Again at Tresavean, the depth of which is 320 fathoms from the surface, the highest temperature yet observed is about 95°. It should, however, be noticed, that the deepest part of Tresavean is in granite formation, and that the Consolidated and United Mines are in slate.

These circumstances go to show that there must be other causes producing heat, apart from the mere depth of the mines; and, without being prepared with conclusive evidence as to its origin, or the source from whence it proceeds, I cannot help remarking that the degree of heat is very much increased by its passing through immense bodies of mineralized matter powerfully acted on by galvanic agency.

TEMPERATURE OF THE GEYSER SPRINGS IN ICELAND.

M. Flourens has communicated to the Paris Academy of Sciences, the results of some observations of MM. Descloizeaux and Bunsen in July,

1846, on the Intermittent Boiling Springs of the Geyser and Strockr,* the latter being within 140 yards of the Great Geyser.† The observations were on the temperature of the water, in the great column or well of each, made by suspending thermometers at different depths, at different times, before and after eruptions. The Great Geyser has a depth of 22 metres (72 feet), and the experiments showed that the temperature of the column diminished gradually from the bottom upwards, and that the maximum temperature at the bottom before a great eruption was 127°·6 Centigrade (260½° Fahr.), and the minimum 122° (251½° Fahr.), after an eruption. The temperature of the water at the surface was 85°·2 (185° Fahr.), when that at the bottom was 127° C.

After an eruption, the lowest thermometer stood at 121°·6 (251° Fahr.); nine hours afterwards at 123°·6 (254½° Fahr.). Between 11 A.M. of the 6th July, and 2·55 P.M. of the 7th, there was no eruption, so that there had been an interval of nearly 28 hours; and the water at the latter time, at the bottom, was 127°·6 (261½° Fahr.); a quarter of an hour afterwards there was a slight eruption.

The Strockr is a circular well 44½ feet deep, with an orifice of about 8 feet, which rapidly diminishes downward, and at about 27¼ feet from the orifice is only 10¼ inches. The column of water between the eruptions has a mean depth of 27½ feet, so that its surface, which is in a constant state of ebullition, is generally from 10 to 13 feet below the surface of the ground. The temperature of the water at the bottom varied from 112°·9 to 114°·2 (235° to 237½° Fahr.), and the same temperature continued throughout a depth of about 20 feet, when it began to sink, and at the surface of the water the thermometer stood at 100° (212° Fahr.)

These observations on the temperature of the water are highly curious and important. We have a temperature of 261° Fahr. at the bottom of a free open column of water, in which thermometers could be suspended on a line dropped from the surface; while it might have been expected that, as soon as a film of water at the bottom was raised to a higher temperature, it would ascend, and be replaced by a colder and heavier film; and that thus a constant current would be established throughout the column, until the whole arrived at a temperature of 212°, when ebullition would commence and continue. The pressure of the column of water may, perhaps, account for the high temperature at the bottom, especially if the free circulation be impeded by the sides of the well not being vertical, and still more by projections in the sides causing contractions of its diameter. But the experiments of M. Donny, of the University of Ghent, published in the 17th volume of the Memoirs of the Royal Academy of Sciences and Belles Lettres of Brussels, on the Cohesion of Liquids, may perhaps be considered as throwing some light on this phenomenon of the Geyser. By a series of carefully conducted experiments, M. Donny has shown:—

1. That the constancy of the boiling point of water, under ordinary

* It is called Strokkus in the Comptes Rendus, but Henderson calls it Strockr, and says the name is derived from the verb "Strocka," to agitate, or bring into motion.

† Hendersen's Iceland, p. 69.

atmospheric pressuure, depends upon its containing a considerable quantity of air.

2. That there is a marked difference between the boiling point of water containing air, and of water freed from air.

3. That a small quantity of air dissolved in water, is sufficient to attenuate greatly the *cohesion existing between the molecules of the water.*

4. That when water is freed from air as far as is possible, the cohesion of the molecules is so increased, that a higher temperature is necessary to overcome it, and that the boiling point is very considerably raised.

M. Donny succeeded in raising the temperature of water so freed of air to 135° Centigrade (equal to 275° of Fahr.), under the ordinary atmospheric pressure, without its exhibiting any symptom of ebullition—shewing, that the cohesion of the molecules was nearly equal to the pressure of the three atmospheres on water containing air. This is a fact most important to bear in mind in reasoning upon many geological phenomena, particularly those connected with the solution of silica.

The further researches of M. Donny, recorded in the same memoir, appear also to offer an explanation of the violent and intermittent eruptions of the Geyser; for he states, that if water deprived of air be exposed to so considerable an increase of temperature as to overcome the force of the cohesion of the molecules, the production of vapour is so instantaneous and so considerable as to cause an explosion. Water long boiled becomes more and more deprived of its air, and M. Donny attributes the sudden bursting of the boilers of steam-engines to this cause.—*Address delivered at the Anniversary Meeting of the Geological Society of London. By Leonard Horner.—Jameson's Journal*, No. 85.

CONNEXION OF THE GEYSERS.

M. A. Descloizeaux has communicated to the *Annales de Ch mie et de Physique*, a valuable paper of "Physical and Geological Observations on the principal Geysers of Iceland," which is translated in the *Philosophical Magazine*, No. 203. At the close, M. Descloizeaux observes—

Some observers have admitted that there was a direct communication between the Strokkur and the Geyser: unfortunately, I was not able, during my visit, to collect water from the Strokkur sufficiently freed from the earthy matters coming from the clods of earth which we threw upon it during the first days of our arrival, to bring it back and submit it to an accurate analysis; but the quantity of sulphuretted hydrogen, which I found to be $1^{cc}{\cdot}748$ per litre, differs sufficiently from that which the Geyser contains, to allow us to conceive that these two springs, subjected perhaps to the same cause of subterranean heat, are not, as has been thought, in immediate connexion.

TEMPERATURE OF THE OCEAN.

The circle of mean Temperature of the Southern Ocean is a standard point in nature, which, if determined with very great accuracy, would afford to philosophers of future ages the means of ascertaining if the globe

we inherit shall have undergone any change of temperature, and to what amount, during the interval.

The experiments which limited time and means admitted of Sir James Ross making, serve to show that the mean temperature of the ocean at present is about 39°·5, or $7\frac{1}{2}°$ above the freezing point of pure water; and as nearly as possible the point of its greatest density. But it would be indispensable that this temperature should be ascertained to the tenth part of a degree; and as we now know where we may send any number of thermometers down to the greatest fathomable depths, without an alteration of temperature, even to that small amount, this desideratum might be very easily obtained.

These observations force upon us the conclusion, the internal heat of the earth exercises no influence upon the temperature of the ocean, or we should not find any part in which it was equable from the surface to the great depth we have reached; a new and important fact in our physics of the globe.—*Sir James C. Ross' Voyage to the Southern Seas*; *quoted in Jameson's Journal*, No. 86.

ORGANIC BODIES IN HAILSTONES.

Dr. Waller has communicated to the *Philosophical Magazine*, No. 200, some additional observations on Hail, and on the Organic Bodies contained in Hail-stones; and thence we obtain the following information. A hail-stone, perfectly white, when examined under the microscope, presented the usual appearance of being composed of minute particles of ice, some spherical, others of a more irregular shape; and many bubbles of air escaped as it melted. The organised substances contained in the drop of water which resulted were numerous. Most of them were of an irregular shape with angular outlines. Others were globular, and some of these were completely black, with a nucleus in the centre. With higher magnifying powers were seen green globules about $\frac{1}{5000}$ of an inch in diameter, which were either collected in clusters, or adhering together in single lines, like the beads of a rosary. The drop of water, secured in an apparatus nearly air-tight, was found the next day unaltered in size, but the organised matter had entirely changed its character. Some of the organised particles had given off filaments in various directions, presenting the appearance of hollow tubes, jointed at intervals, with a few branches or subdivisions, generally arising at the joints. One or two infusoria were likewise seen moving about with great rapidity. When at rest, their form was oval; but when in motion, their anterior extremity became elongated. Their organisation was extremely simple; no filaments nor appendages of any kind were to be detected about them. Their interior had a granulated appearance. All these characters indicate that they belong to the genus *Uvella* of the monadinæ, and probably of the species *Uvella glaucoma* (Ehrenberg.) On the second day, the vegetable filaments had greatly augmented in number. Small elongated cells could be seen at various places, as if forming the first elements of the tubulous branches spread out arounld them. The infusoria had likewise greatly increased in number. The next day again the same appearances were presented. Scarcely any alteration could be detected in the vegetable and animal bodies, the last were

as active in their movements as before. Dr. Waller purposed to continue the seobservations every day, in order to ascertain their future changes; but unfortunately, by some accident, one of the slips of glass belonging to the apparatus was broken, and in consequence the water quickly dried up; so that when next examined the infusoria were found to be dead. The further addition of water was ineffectual to restore the vegetable particles to life.

LIGHTNING CONDUCTORS.

Sir W. Snow Harris has communicated to the British Association, a paper "On some Recent and Remarkable Examples of the Protection afforded by Metallic Conductors against Heavy Strokes of Lightning." The possibility of guarding buildings and other structures against the destructive effects of lightning, has been made a great question in practical science, from the time of Franklin to the present day; and it is of considerable public importance, seeing the frequent damage which occurs to our beautiful churches and other edifices by strokes of lightning, to bring this question completely under the dominion of induction, observation, and experiment. The general principles which Sir W. S. Harris submitted as deducible from the inquiries to which he alluded are these:—If we imagine a ship or building to consist altogether of metallic substances, it would certainly be secure from any damage by lightning; and for this simple reason, that what we call lightning is the result of the electrical agency forcing a path through resisting mattter such as the air, and extricrating with explosive and expansive force, both light and heat in its course. When, on the contrary, it falls upon comparatively non-resisting bodies, such as the metals, then this form of lightning vanishes, and the discharge assumes, if the metallic body be sufficiently capacious, the form of a comparatively quiescent current. Our object should be, therefore, in defending any building or ship from lightning, to bring the general mass so far as possible into that passive or comparatively non-resisting state it would have, supposing it a mass of metal. This is, in fact, the single and simple condition of such an application, without any reference whatever to assumed forces of attraction or peculiar specific powers manifested by certain bodies for the matter of lightning, and which really do not exist. This simple principle, by a careful mechanical arrangement, calculated to render it practical and applicable to all the duties which the general structure of a ship together with its masts has to perform, is now universally carried out in the navy, with the most perfect success; so that damage by lightning in the vessels thus fitted has, for the last fifteen years, quite ceased. The masts are made completely conducting by capacious plates of copper, reaching from the highest points to the keel; they are tied into one general connexion with all the great metallic masses employed in the construction of the hull, and united by the large bolts of copper passing through the keel and sides, with the copper expanded over the bottom and with the sea. It is quite impossible that a discharge of lightning can fall on the vessel in any place, and not be at once transmitted safely by the conductors, not under the form of lightning, but under the form of a cur-

rent without explosion. Sir W. S. Harris then referred to some remarkable cases in illustration of the principles.

THE LUNAR THEORY.

THE Astronomer Royal has communicated to the British Association, the following, on a most important and interesting discovery of the previous year.

"In the Lunar Theory a very important step has been made in the course of the past year. When, near the beginning of the present century, a considerable number of the Greenwich lunar observations were reduced by Bürg for the purpose of obtaining elements for the construction of his Lunar Tables, and generally for the comparison of the moon's observed place with Laplace's theory, it was found impossible to reconcile the theoretical with the observed places except by the assumption that some slowly varying error affected the epoch of the moon's mean longitude. From the nature of the process by which the errors of the elements are found, the conclusion upon the existence of this peculiar error is less subject to doubt than that upon any other error. So certain did it appear, that Laplace devoted to it one entire chapter in the *Mécanique Céleste*, with the title 'On an inequality of long period by which the moon's mean motion appears to be affected.' Guided by the general analogy of terms producing inequalities of long period, he suggested as its probable cause an inequality whose argument depends upon a complicated combination of the longitude of the earth's perihelion, the longitude of the moon's perigee, the longitude of the moon's node, and the moon's angular distance from the sun. But he made no attempt to calculate its theoretical effect. He also suggested an inequality depending on a possible difference in the northern and southern hemispheres of the earth. Many years elapsed before these suggested theoretical inequalities were carefully examined by physical astronomers. At length, the introduction of new methods enabled Poisson and Lubbock successfully to enter upon the investigation of the theoretical values; and they proved that inequalities depending on the arguments suggested by Laplace could not have sensible values. The theory was now left in greater doubt than ever; and suspicion fell even on the accuracy of the reductions of the observations.

A few years since, as is well known to members of the British Association, the British Government, at the representation of the Association, sanctioned the complete reduction, on an uniform plan, of all the observations of the moon made at the Royal Observatory of Greenwich since the year 1750; and the immediate superintendence of this work was undertaken by the Astronomer Royal. The reductions are now printing in all necessary detail; and the press-work is at this time very far advanced. In the last summer, the corrections of the elements of the moon's orbit were generally obtained; and the errors of epoch in particular at different times were found with great accuracy. These results confirmed those of Bürg, and extended the law of the inequality to a much later time. In this state they were exhibited by the Astronomer Royal to Prof. Hansen, of Gotha, who was known to be engaged in the Lunar Theory. Prof. Hansen immediately undertook a search for their theoretical causes. His

perfect knowledge of the state of the existing theories enabled him at once to single out the class of disturbances produced by the action of the planets as that in which the explanation of this inequality would probably be found. In the course of a systematic search, many inequalities of long periods were found; but none of sensible magnitude. At length, two were found, both produced by the disturbing force of Venus, of a magnitude entirely unexpected. One depends upon the circumstance that eighteen times the mean anomaly of Venus diminished by sixteen times the mean anomaly of the Earth increases at very nearly the same rate as the mean anomaly of the Moon: its co-efficient is 27″, and its period 273 years. The other depends upon the circumstance, that eight times the mean anomaly of Venus increases at very nearly the same rate as thirteen times the mean anomaly of the Earth: its co-efficient is 23″, and its period 239 years. The combination of those two explains almost perfectly the error of epoch, which had so long been a subject of difficulty. The discovery of these two inequalities, whether we regard the peculiarity of their laws, the labours expended upon the investigations, or the perfect success of their results, must be regarded as the most important step made in physical astronomy for many years."

ATMOSPHERE OF THE MOON.

A PAPER on this inquiry has been communicated to the British Association, by Mr. Grooby. Whether the Moon has an atmosphere or body of air similar to that which surrounds the Earth, has long been a fertile subject of dispute among philosophers, some affirming its existence and others as strenuously denying it. Some, who take the negative side of the argument, have urged in defence of their opinion, the constant serenity of the moon's surface, always undisturbed by clouds or vapours, and even the smallest of the numerous spots or maculæ which crowd her surface being at all times equally visible. This certainly would be a very strong argument against an atmosphere, were the assertions on which it is founded to be relied upon. But this does not appear to be the case; for, on the other hand, there are many astronomers who affirm that the moon's surface is not always equally clear and distinct. Hevelius says, that he has several times found, in skies perfectly clear, when even stars of the sixth and seventh magnitudes were conspicuous, yet at the same altitude of the moon and the same distance from the earth, and with one and the same excellent telescope, the moon and its maculæ do not appear equally lucid, clear, and perspicuous at all times. He also adds: "From the circumstance of the observation, it is evident that the reason of this phenomenon is not either in our air, in the telescope, in the moon, or in the spectator's eye, but must be looked for in something existing about the moon, that is, I presume, in its atmosphere." Again, the existence of a lunar atmosphere has been denied, because the stars, in an occultation, when just about to disappear behind the body of the moon, retain their full lustre till they seem to touch the very edge, and then vanish in a moment, which phenomenon, it is urged, could not happen if the moon were encompassed with an atmosphere. Here, again, the evidence of different astronomers is at variance, one party affirming, and the

other denying the fact. Nay, even the same individual has sometimes observed both stars and planets to undergo a change, both in brightness, form, and colour, when close to the moon's limb, while at other times he has perceived nothing of the kind. A third argument against the existence of an atmosphere, (and the last I shall notice) is this. If, it is affirmed, the moon were surrounded by an atmosphere, then the duration of eclipses and occultations ought to be diminished by means of its refractive power; and hence a celebrated French astronomer (in a memoir written expressly on this subject), has endeavoured to demonstrate that, if such an atmosphere did exist, and its horizontal refraction amounted to only eight minutes, there could never be a total eclipse of the sun. But, he continues, in the eclipse of that luminary which happened in 1724 the total darkness continued for two minutes sixteen seconds. Many eminent astronomers concur with the one I have just quoted, in denying that any thing like refraction can exist, or has been observed to exist about the moon's atmosphere; others, equally eminent, assert that they have observed the most unequivocal proofs of it. Both Halley and Euler speak of the evident distortion observable in the sun's limb in total and annular eclipses. The latter, in particular, says, in the eclipse of the sun, which happened in July, 1748, he observed, that when the uncovered part of the sun resembled the moon in her quadrature, the horns of the solar crescent appeared to be bent outwards beyond the circle in which every other part of his disc was comprehended; and when the eclipse became annular, the sun's disc was dilated beyond the circle which formerly embraced it. This dilatation was also observed at Frankfort, and was estimated by Euler at 25°. Here, then, we have one astronomer observing in a solar eclipse a refraction of $12\frac{1}{2}°$, while another, from his observations, denies that any perceptible refraction does or can exist.

From such contradictory evidence, it seems extremely difficult to draw any thing like a satisfactory conclusion. The most probable one seems to be this:—That the moon is surrounded by an atmosphere in some respects like our own, but much rarer; and that it is differently modified by the peculiar circumstances attached to it. For when we consider, that from the slow motion of the moon on its axis, the principal part of its surface is exposed to the direct force of the sun's rays for fourteen and a half days and nights, without any intermission; and then, for a like period deprived of them, the one producing a degree of cold beyond anything we can conceive, and the other a degree of heat sufficient, probably (if there be water in the moon), to produce a temporary atmosphere of steam,—have we not every reason to conclude, that the atmosphere with which the moon may be, and probably is, encompassed, is materially different in its constitution and properties from that which surrounds our own globe; and which may, in some degree, account for the contradictory statements just noticed.

ATMOSPHERIC TIDES.

Sir R. H. Inglis, President, in his address to the British Association, at their last meeting at Oxford, remarked:—

"The doctrine of the influence of the moon and of the sun on tides

was no sooner established than it became eminently probable, that an influence exerted so strongly upon a fluid so heavy as water, could not but have the lighter and all but imponderable fluid of air under its grasp. I speak not of the influence attributed to the moon in the popular language and belief of nations ancient and modern,—of Western Europe and Central Asia, in respect to disease; but of the direct and measurable influence of the moon and of the sun in respect to the air. It is now clear, as the result of the observations at St. Helena by my friend Col. Sabine, that, as on the waters, so on the atmosphere, there is a corresponding influence exerted by the same causes. There are tides in the air as in the sea; the extent is of course determinable only by the most careful observations with the most delicate instruments; since the minuteness of the effect, both in itself and in comparison with the disturbances which are occasioned in the equilibrium of the atmosphere from other causes, must always present great difficulty in the way of ascertaining the truth, and had, in fact, till Colonel Sabine's researches, prevented any decisive testimony of the fact being obtained by direct observation. But the hourly observations of the barometer made for some years past at the Meteorological and Magnetical Observatory at St. Helena, have now placed beyond a doubt the existence of a lunar atmospheric tide. It appears that in each day the barometer at St. Helena stands, on an average, four thousandths of an inch higher at the two periods when the moon is on the meridian above or below the pole, than when she is six hours distant from the meridian on either side; the progression between this maximum and minimum being moreover continuous and uninterrupted: thus furnishing a new element in the attainment of physical truth; and, to quote the expression of a distinguished foreigner now present, which he uttered in my own house when the subject was mentioned, "We are thus making astronomical observations with the barometer," that is, we are reasoning from the position of the mercury in a barometer, which we can touch, as to the position of the heavenly bodies which, unseen by us, are influencing its visible fall and rise. "It is no exaggeration to say," and here I use the words of my friend the Rev. Dr. Robinson, "that we could even, if our satellite were incapable of reflecting light, have determined its existence; nay, more, have approximated to its eccentricity and period."—*Report in the Athenæum*, No. 1026.

Col. Sabine's paper, "On the Lunar Atmospheric Tide at St. Helena," above referred to, has been read to the Royal Society. The results of the observations made by Captain Lefroy, of the Royal Artillery, Director of the Magnetical and Meteorological Observatory at St. Helena, are here given; from which it appears, on the examination of the barometrical changes during seventeen months, that a maximum of pressure corresponds to the moon's passage over both the inferior and superior meridians, being slightly greater in the latter case, and that a minimum corresponds nearly to the rising and setting, or to six hours before and after the former periods. The average atmospheric pressures are 28·2714 inches in the first case, and 28·2675 in the last; the difference being 0.0039 inch. The height of the cistern of the barometer above the sea is 1764 feet; and the latitude of the Observatory 15° 57′ S. These results were still further

confirmed by those of a series of observations during two years. These observations also establish the conclusion, that the moon exerts a greater influence on the amount of atmospheric pressure at the periods of her perigee than at those of her apogee.

NEW ANEMOMETER.

Capt. Cockburn has submitted to the British Association, an Anemometer which is an adaptation to practical use, on board ships at sea, of the plan brought before the Association last meeting by Dr. Robinson, of Armagh. It is seven inches high; the diameter of wings, including the arms, is 16 inches; but from centre to centre of cups only 12 inches; there are four cups, placed at right angles, facing the same way, attached to a spindle by arms, on which is an endless screw, working in the teeth of two multiplying wheels, marked up to 10,000 revolutions. The principle of the concave side holding one-third more wind than the convex, would cause this instrument to revolve one-third as fast as the wind, were there no friction, and the *former* perfect. From various experiments made on top of railway carriages and in steam-boats in calm days, the Captain gave the correction ·5 or $\frac{1}{2}$; though he did not by any means consider this as conclusive, from the difficulty and uncertainty of the trials in a moving body—this will make the multiple 3·5 or $3\frac{1}{2}$, instead of 3; the circumference or distance described by a cup being 3·14 feet, this multiplied by 3·5 will give 10·990 feet, the value of each revolution, or as nearly as possible 11 feet. There being a stop or break fitted to it, which acts instantly, in determining the velocity of the wind, you have only to place it or hold it to the wind, let it revolve any time as convenient, stop it by time of watch, or even a sand-glass, read off the number of evolutions, which, of course, will be the velocity of wind in the time occupied: the number of revolutions in one minute divided by nine will give the velocity of wind in knots, by eight in miles.

A most necessary accompaniment to a marine anemometer is a plan for correcting it for the rate of ship through the water. This has been most happily and cleverly added to this anemometer by Professor Smyth, of Edinburgh Observatory. He suggested applying the law of the parallelogram of forces, in the simple form of scales or rulers: they have a sliding base for the rate of ship; two legs which represent the apparent and the true winds, and which move at any angle the wind may be towards the ship; a circle at each end of the base marked with the points of compass,—these are set to the course of ship, the base to the rate, and the apparent wind-leg to the apparent direction of wind; the true wind-leg brought to cut the apparent at the velocity indicated by the anemometer; this will show the true velocity and true direction of the wind: the scales are graduated up to 100, the greatest velocity given of any wind.—*Athenæum*, No. 1027.

HEIGHT OF AURORAL ARCHES.

Prof. T. Chevallier has communicated to the British Association, a paper on this subject:—"Of all the phenomena of the Aurora Borealis, the arches which are occasionally seen nearly at right angles to the magnetic meridian are the most definite and permanent, and seem to offer

the most promising means of ascertaining the height of the region in which that modification of the aurora is formed. In the 118th No. of the *Philosophical Transactions*, Dr. Dalton has collected several facts on the subject; and arrives at the conclusion that these arches are about 100 miles high. Having computed the height of three such arches, I am desirous of laying the results briefly before the Association. The first was the aurora of March 22, 1841, observed at Dunse, near Berwick, by William Stevenson; at Durham, by myself; at Belfast, by Professor Stevelly; and at York, by Mr. Phillips. The observations over more than an hour, from $8^h\ 56^m$ Greenwich mean time, to 10^h; and the position of the arch was definitely fixed by its place among the fixed stars. The direction of the arch was magnetically east and west. Its height was computed separately from the observations at York and Durham, York and Belfast, Belfast and Durham; the resulting altitudes being 156, 157, and 165 miles. The second auroral arch was observed on Sept. 21, 1847, at Esk, near Durham, by myself, and at Norwich by Mr. W. Marshall. It was visible only for about five minutes. The resulting height is 106 miles. This determination depends upon two observations only. The third auroral arch was seen on the 19th of March, 1847. It was observed at Darlington, at Spalding in Lincolnshire, at Cambridge, at Norwich, in London, Oxford, and Amsterdam. The observations of Darlington and Cambridge, from a base of 172 miles, give an altitude of 175·9 miles; those of Spalding and Cambridge, from a base of 114 miles, give an altitude of 174·4; and those of Spalding and Darlington, from a base of 58 miles, give an altitude of 174·9 miles:—the mean being 175 miles. The extensive area over which this arch was observed is remarkable. A great magnetic disturbance took place at the same time, extending as far as Toronto. In connexion with the cause of these phenomena, it cannot escape notice that there is great similarity between the two kinds of auroral action and the two modes of magnetic action recently discovered by Professor Faraday; the ordinary auroral beams being parallel to the direction of the magnetical meridian, and the arches being at right angles to that direction."

POLARIZATION OF THE ATMOSPHERE.

Sir David Brewster has exhibited and explained to the British Association a beautifully executed map of the lines of equal Polarization. The principal point of his communication was to announce the discovery of a third neutral point, beneath the sun, the existence of which theory indicated, but which he had only succeeded in observing on 22d July, 1846. To Arago, Sir David said, we are indebted for the leading fact upon which polarisation depends. Arago's neutral point is the anti-solar neutral point; Babinet's neutral point is above the setting sun; and now Brewster's beneath the sun, with negative polarization between the risen sun and the horizon. He had observed also a series of phenomena connected with the new neutral point. One he mentioned, namely, a fog driving the point below the horizon, the point again appearing and oscillating as the rarity or density of the atmosphere varied; Babinet's neutral point being at the same time thrown to the zenith.

STORMS IN THE SOUTHERN HEMISPHERE.

An important contribution to the Circular Theory has been recorded by W. Piddington, of Calcutta, in his Thirteenth Memoir of the Law of Storms in the Indian and China Seas. The case detailed is that of a vessel called the *Charles Heddle*, which had scudded in circles during a storm for several days. Mr. Piddington explains how the vessel made five complete circuits, wanting only four points of the compass round the vortex of a storm, by steering always before the wind. Scudding before the wind, the brig was prevented from getting out of the whirlwind, as she would have done had she been steered either towards the east, the north-east, or the south-east.

Allusion is made to this hurricane, and to circuit-sailing in storms, in papers recently published by Mr. Redfield, in the *American Journal of Science*. He says:—

"In the slow progression found in storms of the eastern seas, not only a complete circuit of revolution, but more than one circuit might sometimes be made in a gale by the same vessel, in sailing round the axis of the storm; thus adding another practical demonstration of its revolving character. One such case of complete circuit-sailing I have referred to in 1836. Mr. Thom, in his account of the Rodriguez storm of April 1843, has shown that the *Robin Gray* ran once and a half times round the axis of the storm from left to right, (this being in the *southern* hemisphere), till, being thrown on her beam ends, she was prevented from continuing her circuit. In the same storm, the *Argo* made part of her second circuit, scudding round in the gale in the same direction. In like manner, the *Margaret* made a circuit and a quarter round the axis, chiefly in the heart of the gale. Several vessels, after once falling out of this hurricane, pursued their course, again overtook it, and plunged into the heart of the storm, where they suffered most serious disasters. It appears probable, and indeed certain, that nearly all the great loss and damage sustained in this hurricane might well have been avoided by a knowledge of the laws of rotation and progression in these storms.

"But the most striking case of circular-sailing in a storm is that of the *Charles Heddle*, in a hurricane near Mauritius, in February 1845, which has been furnished me by Mr. Piddington. This was a clipper-built vessel, once a slaver, and was bound from Mauritius to Muscat. It appears from the log, that in her course round and round in the gale, the wind veered five complete revolutions in 117 hours, with an average run of eleven and seven-tenths knots per hour; the whole distance thus sailed being 1373 miles, while the progression of the hurricane at this period *was less than four miles an hour*. The average distance from the gale's axis is estimated at about 45 miles. During this time the vessel made a good course SW. ¾ west, 354 miles only; nearly on the usual course pursued by the hurricane near Mauritius.

"These are results obtained by Mr. Piddington, who has already published his twelfth memoir, and who informs me that he is preparing another on this hurricane of the *Charles Heddle*. In his eleventh memoir he has given us an account of two storms, which were nearly contiguous, but on opposite sides of the equator, and *revolving in counter*

directions, each according to the laws of rotation and progression of its own polar hemisphere."

Some idea may be formed of the figure described in one of Mr. Piddington's charts, of the circuits sailed over by the *Charles Heddle*, by taking one end of a coil of rope, and opening it out upon a deck or floor, in such a manner as to form with the rope five distinct loops. This will also show the direction in which the brig scudded, as ropes are coiled from left to right.

Mr. Piddington is of opinion, that storms do not always dilate in their progress, but, on the contrary, that they sometimes contract; and that when they contract, the squalls of wind partake of an involute direction, drawing ships which scud nearer and nearer to the vortex. Such an action as this may, he thinks, have drawn the *Briton* and *Runnymede* transports towards the same point in their storm in the Bay of Bengal.

These two transports coming from different points, the one from England, and the other from Australia, encountering the same storm, both became involved in the vortex, and were cast on one of the Andamen Islands, within a few yards of the same spot, and at the same time.—*Bermuda Royal Gazette*, Sept. 15, 1846.

MILD WINTERS IN ENGLAND.

An interesting communication on this subject, by Colonel Sabine, appears in the *Philosophical Magazine*. The unusually mild character of the winter of the year 1846-7, in which the mean temperature in December, January, and February, exceeded the mean temperature of the same months of 1844-45 by an average of 8 degrees, has given rise to the inquiry. The winter which, within Colonel Sabine's recollection, most nearly resembled the above, was that of 1821-1822; and undoubtedly the resemblance is in many respects very striking. The extension of the Gulf-stream in that year to the coast of Europe, instead of its terminating as it usually does, about the meridian of the Azores, has been assigned as a cause adequate, Colonel Sabine believes, to account for the phenomena of that winter. "The warm water of the Gulf-stream spread itself beyond its usual bounds, over a space of ocean which may be roughly estimated as exceeding 600 miles in latitude and 1000 in longitude, carrying with it water several degrees higher than the temperature of the sea in ordinary years in the same parallels. The similarity of the two winters 1821-1822 and 1844-1845 having been shewn, and their agreement in those features in which they differ from ordinary winters, Colonel Sabine says, "it will naturally be asked, what evidence we have to prove or disprove an extension of the Gulf-stream in the above year, similar to that which took place in 1821. To this it must be replied, that, strange as it may appear, this remarkable phenomenon may take place in any year without our having other knowledge of it than by its effects, although it occurs at so short a distance from our ports, from whence so many hundred vessels are continually crossing and recrossing the part of the ocean where a few simple observations with the thermometer would serve to make it known. History has recorded two instances in which the extension of the Gulf-stream is known to have taken place; and in both we owe

our knowledge of it to the casual observations of an accidental voyage." —*Jameson's Journal*, No. 86.

M. MELLONI ON THE THEORY OF DEW.

M. MELLONI has addressed to M. Arago, two letters, in which he states that the violent attacks lately made on the Theory of Wells, induced him again to take up the study of Dew. After a very long series of observations and experiments, M. Melloni thinks that he has arrived at a distinct solution of all the questions connected with this interesting phenomenon. The memoir in which they are described has been read to the Academy of Sciences at Naples; two extracts from which have been sent to the Academy at Paris, and will be found translated from the *Comptes Rendus*, in No. 85 of *Jameson's Journal*.

"You will see, my illustrious friend, (writes M. Melloni to M. Arago,) that *there was something to be done;* but the observers who have made such severe attacks on Wells's principle, were instigated by a spirit so blindly hostile, that, far from seeking for anything that might be wanting, they wished to overturn and destroy all, to re-introduce (who could believe it?) the old phantom of the rising of dew from the earth!"

We have not space to detail Melloni's very interesting experiments, but select a few of his most striking results.

After Wells's experiments, we may well admit with perfect safety, that dew does not rise from the earth, that neither does it fall from the sky, and that it is formed by the elastic and invisible vapour diffused throughout the space which surrounds bodies; and it is thus that we have comprehended all, by attributing, with the natural philosopher just named, the precipitation of the aqueous vapour to the cold resulting from the calorific radiation of bodies towards a clear sky.

It appears that dew, properly so called, always requires a certain coldness in the body on which it gathers, and metals exposed to a clear sky are not covered with it, because they cool only in a very trifling degree. But may there not be other influences which prevent the precipitation or accumulation of dew on metals? In other words, is the feeble radiation of metals the only and true cause on account of which these substances are never moistened with dew?

An experiment is then detailed, which appears to M. Melloni to decide this question completely; and it demonstrates, at the same time, the erroneousness of the hypothesis of the rising or falling of dew, as well as the truth of Wells's principle.

Thus, all these facts perfectly accord with the theory of dew adopted by writers on natural philosophy and meteorology. M. Melloni then mentions other facts which cannot well be explained by this theory, but which connect themselves very happily with the principles of Wells.

M. Melloni concludes by thus indicating the principal questions treated of in the memoir:—

"I may say, then, that besides the difficulties of which I have given a distinct solution in these two letters, my new experiments on the nocturnal cooling and on dew have enabled me to understand perfectly, 1st, The distribution of temperature among grass, which is found to be

colder in the night among it than at the surface of the meadow. 2d, The inversion of the ordinary temperatures of the atmosphere near the earth's surface. 3d, The great humidity of the air near plants, from the first instant that the dew begins to appear. 4th, The injurious action of the least breath of wind. 5th, The formation and accumulation of dew during the whole course of the night. 6th, Its successive propagation from below upwards. 7th, The small quantity of dew on trees when compared with grass and low field plants. 8th, The disappearance of small drops of dew, which sometimes takes place on the lower parts of plants, while they are forming on the upper parts. 9th, The variable proportion of the meteor in the different seasons of the year. 10th, Its general distribution over the surface of the globe. 11th, The great difference between the diurnal and nocturnal temperatures of the torrid zone. 12th, The absence of dew in the small islands of Polynesia, and on vessels sailing in the midst of large seas. 13th, Its abundant formation when the vessels approach certain shores of continents. 14th, The sharp cold produced in the night in the sandy plains of central Africa. 15th, The natural and artificial congelation of shallow waters, when the temperature of the atmosphere is from 5° to 6° above zero, by taking into account the indisputable fact that water does not cool more than 1°·5 in consequence of its direct radiation.

"I may finally add, that the part performed by stagnant air in the phenomena of nocturnal refrigeration, appears to me to have modified certain experimental data which have been founded on for calculating the temperature of space."

HEIGHT OF THE PLANE OF VAPOUR IN THE ATMOSPHERE, AND DIFFERENT DIRECTIONS OF SUPERINCUMBENT STREAMS OF AIR.

As opportunities offered, Sir James C. Ross has made experiments to determine the Height of the Plane of Vapour, a desideratum of great meteorological importance, connected with all the most interesting questions regarding the distribution of aqueous vapour over the globe, and the irrigation of the continents. The results of these experiments differed so widely from each other, owing chiefly to the great difficulty of any thing like exact determination in observations of this nature, and probably in some degree from an actual difference of its altitude, under various conditions of the atmosphere, ranging from one thousand two hundred to nearly three thousand feet, as barely entitle them to be esteemed more than a rough approximation, giving an elevation of about two thousand feet as its mean height in the tropical regions.

ON THE COLOUR OF THE WATER OF GLACIERS.

I HAVE had occasion, many times, (says M. Ed. Collomb,) to observe the waters of the torrents which issue from the principal glaciers of Switzerland; those of the two Grindelwalds, the Rosenlaui, the lower and upper Aar, the glacier of the Rhone, that of Viesch, Aletsch, Hinter-Rhein, the valley of Saas, and the valley of Chamouni. In no instance that has come under my observation have the waters proceeding immediately from the melting of the glaciers presented a blue tint; I say *immediately*,

because we can now speak only of the water as examined at a short distance from glaciers. After it has traversed a considerable space, spring-water becomes mingled with it, and when it is collected in a tranquil basin, forming a lake, it is no longer the water of the glacier, but has undergone important modifications. Its constitution and colour are no longer the same.

On issuing from the glacier, the water is always turbid and milky; it is never limpid, as MM. Agassiz and Ch. Martins have already remarked; and, with respect to colour, it is always of a greyish hue. This tint, well known to observant artists, varies infinitely; its scale is very extensive, from greenish-grey to bluish-grey or yellowish-grey, with a great variety of shades. The colour of this water is subject to atmospheric influences; during rain, it is not of the same hue as in clear weather. I could judge of the variations in colour it undergoes, while making a series of regular observations at the terminal vault of the glacier of the Aar, in 1845 and 1846, for experiments in gauging.

In fine weather, when viewed from a distance in a mass, it has a grey, tarnished, and opaque appearance; it holds a great quantity of mineral particles in suspension. During rain, the grey changes to ochre-yellow; when examined in a flask or glass, the difference of hue partly disappears. All this is explained if we take the origin of this water into consideration. It is derived from four different sources:—1st, from the ice; 2dly, from the superior nevé; 3dly, from rain; 4thly, from atmospheric condensation, (the spring-water which may rise under a glacier is insignificant.) Before reaching its terminal point, it performs an important part in the economy of the glacier. By means of canals and capillary fissures, it circulates throughout the entire mass, and carries along with it the bodies it encounters in its passage.

Independent of the mineral particles whose origin is known, it likewise holds in suspension a great quantity of organic fragments, both vegetable and animal. The Mers de Glace of the high alpine regions are inhabited by a multitude of organised beings as yet little known. Thus MM. Ch. Vogt and Bassnitz, who have entered upon investigations (partly unpublished,) relating to red snow, which is very abundant on glaciers, have discovered under the microscope, and I can myself verify the fact, that besides the sporules of *Protococcus* which constitute the red snow, the waters of glaciers contained a very great variety of fragments of hitherto undetermined cryptogamous vegetables. I have no doubt that further researches will enable us to introduce a glaciary flora into science.

With regard to animal organisms, M. Desor was the first to make known the existence of glacier fleas (*Desoria glacialis.*) They are found over the whole extent of the surface. On the glacier of the Aar, we have only to lift the first stone from the median moraine to discover myriads. These small insects are so numerous in their icy dwelling, that it acquires a blackish hue from them. They are unable to subsist on distilled water; they must therefore be supported by some organic remains. We have tried to feed them with the stalk and sporules of the protococcus without any conclusive result. Inclosed in a vessel surrounded with a cold mix-

ture, they are unable to support a temperature of — 18 Centigrade degrees. This degree of cold kills them in a few seconds.

These facts ought to be impressed on the memory of those who have occasion to visit glaciers; they show that there is a peculiar organisation to be studied in such places. A numerous series of microscopic beings belonging to the vegetable and animal kingdom live and prosper in the bosom of the ice, at a height of 2,500 metres above the level of the sea.

On the other hand, it is not less clearly proved, according to the laws which regulate the movements of glaciers, that the entire mass renews itself at the end of a certain number of years, and contains the mineral, vegetable, and animal remains which exist on their surface and in their interior; they all reach in succession the terminal talus, and are again found in waters which flow from the inferior vaults. Hence the origin of their great impurity, and the grey, milky colour, without transparency, which characterises them.—*Comptes Rendus: Jameson's Journal*, No. 86.

GREATEST ASCERTAINED DEPTH OF THE OCEAN.

On the 2d of June, when in latitude 15° 3′ S., and longitude 26° 14′ W., being nearly calm, and the water quite smooth, we tried for, but did not obtain, soundings with 4,600 fathoms of line, or 27,600 feet. This is the greatest depth of the ocean that has yet been satisfactorily ascertained, but we have reason to believe that there are many parts of it where it is still deeper. Its determination is a desideratum in terrestrial physics of great interest and importance.—*Sir James C. Ross' Voyage to the Southern Seas.*

PHOSPHORESCENCE OF THE SEA.

Dr. Pœppig, in his recent *Voyage to Chili*, thus describes this phenomenon:—From the topmast of the sea appeared, as far as the eye could reach, of a dark red colour, and this in a streak, the breadth of which was estimated at six English miles. As we sailed slowly along, we found that the colour changed into brilliant purple, so that even the foam, which is seen at the stern of a ship under sail, was of a rose colour. The sight was very striking, because this purple streak was marked by a very distinct line from the blue waters of the sea, a circumstance which we the more easily observed because our course lay directly through the midst of this streak, which extended from south-east to north-west. The water taken up in a bucket appeared, indeed, quite transparent; but a faint tinge of purple was perceptible when a few drops were placed upon a piece of white china, and moved rapidly backwards and forwards in the sunshine. A moderate magnifying glass showed that these little red dots, which only with great attention could be discerned with the naked eye, consisted of Infusoria, which were of a spherical form, entirely destitute of external organs of motion. We sailed for four hours, at the mean rate of six English miles an hour, through this streak, which was seven miles broad, before we reached the end of it, and its superficies must therefore have been about 168 English square miles. If we add that these animals may have been equally distributed in the upper stratum of

water, to the depth of six feet, we must confess that their numbers infinitely surpass the conception of the human understanding.

ON THE ORIGIN OF CONTINENTS. BY JAMES D. DANA.*

In a paper on the Volcanoes of the Moon, read before the Association of Geologists and Naturalists, in September 1846,† some suggestions were thrown out with regard to the Origin of Continents, drawn from the condition of a cooling globe. It was observed that the portions of the earth now constituting the great areas of land, were free, or nearly so, from volcanic action, even in the Silurian period: while the oceans appear to have been regions of eruption. Hence it was inferred that contraction must have taken place to the greatest extent over the parts now oceanic, just as any cooling sphere becomes depressed on the side which cools last. This was shown to correspond with the actual history of our globe, inasmuch as an increasing depth in the ocean cavity would necessarily leave more and more land above water in successive epochs, as accords with observations. It was observed that the hypothesis was *farther* borne out by facts: for while it appears that the land has, on the whole, been increasing in extent, even through the tertiary era and subsequent to it, the ocean's bottom has actually subsided several thousand feet within a late period, as shown by the coral islands scattered over the wide Pacific.‡

By reference, therefore, to the principle of unequal contraction, and to those *subordinate* causes of change of level usually appealed to by geologists (though treated of commonly as primary in importance), we may obtain a general view of the origin of the earth's features. I propose at this time to offer a few remarks in illustration of this subject, derived from the features of our own continent, reserving a fuller discussion for another occasion.§

* From the American Journal of Science, vol. iii., second series.

† See American Journal of Science, vol. ii., second series, 352, and also p. 10 of the 43d volume of Jameson's Journal.

‡ If we consider that *two hundred islands* have subsided in the Pacific, which, had there been no corals, would have disappeared without a record, we perceive that the comparative absence of islands from the Atlantic, whose waters are, to a large extent, too cold for corals, proves nothing against the hypothesis. On the contrary, so large a bare surface of waters is probable evidence of the disappearance of some points of land by submergence. All existing Atlantic islands are of igneous origin except the Falklands, to the east of Tierra del Fuego.

§ We may here mention one or two facts in corroboration of the general theory, that the more igneous portions of the globe have contracted most and thereby became submerged. For example, we find the continent of America reduced to a narrow strip of land, just where the great American tract is crossed from east to west by a region of igneous action, not yet entirely extinct; that is, about the West Indies and the adjoining isthmus. This region became thus depressed and submerged, in consequence of greater contraction below; and hence North and South America are nearly disjoined by a broad arm of the ocean. This single instance is the only one, through the continent of America, of volcanic eruptions east of the great western chain of mountains.

Again, the East Indies, another region of perpetual fires, in the earth's history, constitute a cluster of islands separating from Asia the large non-volcanic New Holland, properly a part of a south-eastern extension of the

The effects of contraction as a geological cause, though long admitted, have been first brought out in their various bearings by M. Constant Prévost, before the Geological Society of France.* The facts adduced substantiate his views, though, as we believe, with some limitations. They lead us further to connect the various phenomena, and tell why the ocean and the land have their present bounds. (See the paper quoted in *Jameson's Journal*, No. 80.)

REPORT ON GEOLOGICAL THEORIES OF ELEVATION AND EARTHQUAKES. BY MR. W. HOPKINS.

This Report, made to the British Association at their late meeting, embraces too wide a range to admit of our giving any detailed analysis. After having stated certain leading characters of Volcanoes, both with reference to the fluid volcanic mass and its containing cavity, the author proceeds to the examination of Theories of Volcanoes. He regards the *chemical theory* proposed by Sir H. Davy, and the theory more recently proposed by M. Bischoff, as involving mechanical difficulties of the gravest character. In considering the theory which supposes existing volcanoes to owe their origin to the former fluidity of the earth, the author is led to the discussion of the general theory based on the hypothesis of such fluidity. He examines the evidence afforded in favour of this hypothesis by the accordance between the present ellipticity of the earth, as determined by admeasurement, and its mean density as determined by the experiments of Cavendish and Baily, and the calculated value of their quantities. He then proceeds to consider the mode of the earth's refrigeration and consequent solidification, and the probable extent to which the latter process has already proceeded. Supposing the earth to consist of a fluid central nucleus and a solid envelope, it is concluded that the thickness of the latter is probably not less than one-fourth or one-fifth of the earth's radius. This conclusion is drawn from the observed amount of the precession of the earth's pole with that calculated on the hypothesis just stated, respecting the constitution of the earth; but the author also indicated another method by which evidence might be obtained on this point. He showed that if it could be proved by experiment that the temperature of fusion of solid substances is generally increased, even in a small degree, by high pressure, we should have strong reason to believe in the entire solidity of the earth; and if, on the contrary, it should appear that high pressure has no such effect on the temperature of fusion, we should be led to conclude that the present temperature of the earth is not due to its original heat. He considered such experiments necessary for the further advance of this branch of geology.—*Athenæum*, No. 1028.

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continent. Moreover, we may account for the fact that this Archipelago has not farther subsided, so as to become a deep ocean with few islands, on the ground that extensive areas of land, without fires, exist in the midst of the group, Borneo being one example, equalling in extent half the United States, east of the Mississippi. The Indian Ocean, at the same time, bears evidence, in its coral islands, of a much more extensive subsidence.

* See American Journal of Science, vol. ii., ser. ii., p. 355.

ACTIVE VOLCANOES IN THE ARCTIC AND ANT-ARCTIC REGIONS.

THE earth's crust, as we approach towards the pole in the southern hemisphere, presents, in a remarkable degree, the most striking indications of the vast subterranean fires pent up within it, and, as we now find, having vent in both the frigid zones; the Volcano of Jan Mayen actively burning within the Arctic Circle; and Mount Erebus, rising from the lofty mountain range of the newly-discovered continent of Victoria to an altitude of more than 12,000 feet above the level of the Ant-Arctic Ocean, and sending forth its smoke and flame to the height of 2,000 feet above its crater, the centre of volcanic action in those regions of eternal snow.—*Sir J. C. Ross' Voyage to the Southern Seas.*

HYBRID ANIMALS.

THE facts connected with Hybridity in the inferior classes of Animals, have an important bearing on one of the most interesting questions in Ethnography; and, in reference to this question, an important paper has been read before the Academy of Natural Sciences at Philadelphia, by D. S. G. Morton, author of *Crania Americana, &c.* The entire contribution will be found in *Jameson's Journal*, No. 86. We quote the author's concluding "remarks":—

While we admit that hybrids, as a general law, are contrary to nature, we are also compelled to concede that this law has very many exceptions. "It is manifest," says Dr. Prichard, "that there is some principle in nature which prevents the intermixture of species, and maintains the order and variety of the animal creation. If different species mixed their breed, and hybrid races were often propagated, the animal world would present a scene of confusion. By what method is this confusion prevented? The fact seems to be, that the tribes of wild animals are preserved distinct, not only by the sterillity of mules, but that such animals are never, in the state of nature, brought into existence. The separation of distinct species is sufficiently provided for by the *natural repugnance* between individuals of different kinds. This is, indeed, overcome *in the state of domestication*, in which the natural propensities cease, in a great measure, to direct their actions.*

But we have seen that males are not always sterile, and also that hybrids are really produced in a state of nature, wholly independent of the influence of cultivation; facts which, indeed, are admitted and illustrated by Dr. Prichard in his later writings. That domestication evolves the faculty of hybridity there can be no question; and we would apply the principle to various classes of animals. It will materially assist in explaining so great a variety in some animals, by pointing, as De Azara and Hamilton Smith have suggested, to certain primitive species, which were endowed with the capacity for reproducing among themselves, especially under the influence of domestic culture. We have shewn that this fact is unquestionable among some quadrupeds and some birds, of which the hybrid varieties have been cultivated for the uses of men.

Could we trace back the origin and history of various other species, we

* Researches into the Physical History of Mankind, i., p. 97, *2d Edition.*

should, in all probability, arrive at the very same result; for it appears to be a law of nature, that the faculty possessed by different species of animals of producing fertile hybrid offspring, is in proportion to their aptitude for domesticity.

Now, since man possesses this aptitude in the highest degree, being, as Blumenbach expresses it, the most domestic of animals, it would be nothing singular if he possessed the power of fertile hybridity, even if the human family should prove to embrace several distinct species; because, as we have fully shewn, this phenomenon is not unfrequent among animals whose specific, and even generic diversities, are unquestionable. If, therefore, domestication, or, as we have termed it, the aptitude for domesticity, explains the fact in one instance, it certainly does so in the other; more especially since fertile reproduction has ceased to be evidence of identity of species.

A word with respect to the theory of *repugnance*. The same phenomena, moral as well as physical, take place, to a certain extent, among men as among animals; for the repugnance of some human races to mix with others has only been partially overcome by centuries of proximity, and, above all other means, by the moral degradation consequent to the state of slavery. Not only is this repugnance proverbial among all nations of the European stock among whom negroes have been introduced, but it appears to be almost equally natural to the Africans in their own country, towards such Europeans as have been thrown among them; for with the former a white skin is not more admired than a black one is with us.*

1. A latent power of hybridity exists in many animals in the wild state, in which state, also, hybrids are sometimes produced.

2. Hybridity occurs not only among different species, but among different genera; and the cross-breeds have been prolific in both cases.

3. Domestication does not cause this faculty, but merely evolves it.

4. The capacity for fertile hybridity, *cæteris paribus*, exists in animals in proportion to their aptitude for domesticity and cultivation.

5. Since various different species of animals are capable of producing together a prolific hybrid offspring, hybridity ceases to be a test of specific affilation.

6. Consequently, the mere fact that the several races of mankind pro-

* See the travels of Hawkins, Browne, Buckhardt, Caillet, &c., for abundant evidence of this fact.

I must here be permitted to offer a single additional remark. It is obvious that while cultivation produces obvious changes in some animals, its influence has had little or no effect on others; for example, the ass, the rat, and the mouse, among quadrupeds, and the peacock and guinea-fowl among birds. These species have been domesticated from immemorial time, in all latitudes, under every conceivable variety of circumstances. Among wild birds and quadrupeds, on the other hand, some undergo very remarkable changes in a state of nature, as some species of squirrel, fox, wolf, &c., while other species of the very same genera undergo no change whatever. Hence the fallacy of drawing inferential conclusions from those that *do* change in order to explain the phenomena of diversity among men.

The diversities of animals are in some cases owing to exterior causes alone; in other instances they arise solely from amalgamation of species; while in a third class we can trace the operation of both these agents.

duce with each other a more or less fertile progeny, constitutes, in itself, no proof of the unity of the human species.

THE NERVOUS SYSTEM.

Dr. Marshall Hall has read to the Royal Society, "Researches into the Effects of certain Physical and Chemical Agents on the Nervous System." In this paper, to which the author considers his former communication as strictly preliminary, he treats of what he terms the electro-genic state in the spinal marrow and in incident nerves, and gives the details of the collateral experiments alluded to at the close of his last paper. He also submits to the consideration of the Society the following circumstances: "1. The electro-genic state of the nerves admits of being discharged, and is capable of inducing the phenomena of voltaism in other nerves. 2. This state is inducible by momentary and slight voltaic currents. 3. It is more inducible by the reverse than by the direct voltaic current, as stated by others. 4. When a nerve forms a part of the voltaic circle, new and superadded circles may be effected, which, by inducing a *change* in the condition of the first, result in the phenomena of muscular contractions. 5. When the voltaic circle is either complete, or, being completed, is broken, and various parts of the wires and animal tissues which form or formed that circle are connected by a conductor, a series of phenomena is produced, some of which still require explanation. 6. It is also important, especially in a medical point of view, to observe the manner and degree in which the *vis nervosa* and the *vis muscularis* are diminished by repeated voltaic action." In conclusion the author observes: "I have purposely and carefully avoided all theoretical views, confining myself to the accurate detail of experiments. The condition induced in the nervous system by a current of voltaism I have denominated the *electro-genic*. It might be used as one of polarization, its discharge one of depolarization. But I have nothing to add to these views beyond what is universally known. The phenomena of the continuous, interrupted, and sudden discharge of the electro-genic condition, have not, I believe, been traced and detailed before."—*Literary Gazette.*

ATMOSPHERIC WAVES.

Mr. W. R. Birt has made to the British Association his fourth Report on this inquiry. In accordanee with the resolution adopted at the last Meeting of the Association, about thirty sets of observations had been obtained from various stations in the British islands; the extremes of the area embraced being the Orkneys and Jersey in one direction, and Galway and Dover in the other. As instances of the increasing interest manifested on this subject, he remarked that he had been furnished with curves from stations in the north, where the barometric movements had been considered to result from the transit of the great November wave. Each of these curves was referred to the same period; namely, from the 2nd to the 17th of November; and the observers invariably regarded the regular rise and fall that occurred between these epochs as indicating a well-marked return of the great symmetrical wave.

Mr. Birt, after noticing the remarkable circumstances under which the

wave returned in the autumn of 1846, so remarkable that they had no small tendency to mask the wave in the south-eastern part of the island—stated that the projected curve at London strikingly developed its essential essential features; the *five* subordinate waves were well seen, although the inflexions were not strong, owing to the small altitude of the wave on its last return, scarcely exceeding half an inch—its whole development occurring above thirty inches prevented the boldness of the inflexions particularly noticed on the occasion of its return in 1842.

The author then proceeded to notice the essential features of the curves as obtained from the observations at Ramsgate, St. Vigean's, near Arbroath, east coast of Scotland, the Orkneys and Western Isles, Arbroath, east coast of Scotland, the Orkneys and Western Isles, Applegarth Manse, Dumfries-shire, Largs, Limerick, Galway, Helstone in Cornwall, and St. Helier's, Jersey. Our limits will not permit us to give in detail the resemblances and differences of these curves, exhibiting, as they do, the distribution of pressure around Great Britain and Ireland, which the author traced from the south-eastern point towards the north-west: but the Report will be printed in the forthcoming volume of the Transactions. We may, however, here notice that attention was called to the principle which the author laid down in his Report of 1846, "that the barometric curve, including a complete rise and fall at any one station, does not represent any reality in nature, but is the effect of two or more systems of waves or currents moving in different directions and crossing each other at various angles." He also pointed out the great extent of oscillation (nearly double) observed in the north-west as compared with the south-easterly observations. The great wave commenced on the 2d of November; at the northern stations it culminated on the 12th; at the south-eastern on the 9th; and it terminated on the 17th. In explaining the differences of epoch as indicating the transit of the crest being much earlier in the south-east than in the north, Mr. Birt remarked that the observations clearly showed that the barometer passed *two* maxima, one on the 9th, the other on the 12th; and that the whole extent of the British Isles might be divided into *two* barometric areas, distinguished in one case by the superiority of the maximum of the 9th, and in the other by the superiority of the maximum of the 12th. A line passing between Arbroath and Newcastle, south of Dumfries, and between Ireland and Wales, seperates these areas. North-west of this line we find the maximum of the 12th superior: south-east of it we find the maximum of the 9th superior. The maximum of the 9th Mr. Birt regarded as the central wave forming the crest of the great wave, and the maximum of the 12th he considered as the crest of the first subordinate wave on the posterior slope.

The author next proceeded to examine the distribution of pressure as manifested by these observations; from which, in connexion with the features of the projected curve, he deduced the following results:—1st. The return of the great symmetrical wave. This occurred in the south-eastern angle of our island under very peculiar and remarkable circumstances. The area of greatest symmetry is closely in accordance with the results of former discussions, and goes far to confirm the result deduced

from the examination of Sir John Herschel's hourly observations, "that Brussels is entitled to be considered as a point of comparatively gentle barometric disturbance, * * * and may be regarded as in a certain sense a *nodal* point, where irregularities are smoothed down and oscillatory movement in general is more or less checked; and such movements increase as we recede from Brussels as a centre, especially *owards the north-west*." The curve of greatest symmetry was obtained from Ramsgate, the nearest station to Brussels. As we proceed *towards the north-west*, the symmetry is considerably departed from, especially by the greater development of the first subordinate wave on the posterior slope, by which the maximum of the 12th became superior. This portion of the wave formed a striking contrast to the similar portion in 1845, which was characterized by a considerable depression. It is not a little curious, remarked the author, and goes far to show that we are approaching the true explanation of the *nodal* character of Brussels, to observe that movements so dissimilar in their character, so opposite in the value, and presenting themselves under such a diversity of aspects, should, in a certain locality and on particular lines of country, manifest, by means of the barometer, constant and well-defined phenomena, that may be recognized year after year, and which give to the curves of barometric rise and fall during the period of their occurrence a peculiar symmetrical appearance.

2nd. Two systems of waves or currents, one having a *general* direction of progress from the north-west, the other from the south-west, traversed the area during the period of the great wave. This is the same result to which we were conducted by an investigation of the symmetrical wave of 1842. The relative positions of the individual waves were somewhat different from those of the wide bi-dual waves of 1842; but there were some striking points of resemblance. The north-westerly system in each case exhibited the largest wave, both as regards amplitude and altitude. The intervals between similar phases of north-westerly waves were equal in 1842 and 1846. During the interval that elapsed between transits of these similar phases in 1842 and 1846, the same number of south-westerly waves passed over the area; and from the whole it appears highly probable that we have not only ascertained another return of the great symmetrical wave, (the sixth), but have also detected the return of at least *three* of the individual waves contributing to its production.

3rd. The very precipitous fall of the barometer characterizing the posterior slopes of the north-westerly system, as developed by the discussion of the observations of 1842, is fully confirmed: in connexion with this, the decrease of oscillation from the north-west towards the south-east is also strikingly developed, as on former occasions.

The author, in alluding to the area over which these observations extend, remarked that the British Isles present a far too limited area for the purposes of examining thoroughly these atmospheric movements; he observed that in the more extensive examination which the movements of Nov. 1842 are now undergoing, there are four stations at which the barometric changes are of an opposite character during the first eight days of Nov.

—namely, Christiana and St. Petersburgh, in the north, and Paris and Geneva in the south. The curves at St. Petersburgh and Geneva present the most decided opposition; rising at the one while falling at the other. The turning point in each case occurred on the 5th. These opposite movements he conceived to be occasioned by the opposite slopes of two waves passing from the *south-west*, and that the *half* breadth of each wave extended at least from Geneva to St. Petersburgh. Such being the extensive character of the waves in question, in order to judge them in their totality it will be absolutely necessary to enlarge the area of observation. The centre of Europe is well dotted over with barometers, from which accurate results may be obtained: but even the British Isles in connexion with that portion of Europe now under observation, form but a small part of the vast space over which the waves themselves extend. St. Petersburgh is an important northern station, from which we have most excellent observations; but we require them also from Iceland, the northern parts of Norway, Sweden, and Lapland, and also from Archangel in one direction, and from the southern parts of France, from Spain, Portugal, and the northern parts of Africa, in the other; also from the Mediterranean they would be highly important. Observations stretching from the most western point of Africa to the extreme north of Europe, would go far to determine the longitudinal directions of the north-westerly systems of waves.

In reporting the general progress of the inquiry, Mr. Birt stated that we are now in possession of materials for examining the great symmetrical wave, not only in particular years, as 1842, 1845, and 1846, but also over the central parts of Europe and the dominion of the Russian empire, as far as Sitka, on the north-west coast of America. He has combined observations extending from the west coasts of Ireland and the Orkneys on the one hand, to St. Petersburgh and Geneva on the other; and he apprehends that the whole of the barometric movements over this area, which occurred during the first eight days of November 1842, are fully explained by the transits of two large waves on two sets of parallel beds of oppositely directed winds—one from the south-west, the other from the north-west.

In connexion with this, the author observed that a most important point appeared to be developing itself by means of these observations. Those from the north-west appeared strongly to indicate that somewhere in that direction, the origin of the great barometric disturbances (a centre of oscillation) giving rise to the waves that pass onwards towards the south-east is to be sought. We have already obtained the *nodal* point of the two great systems of European barometric undulations—namely, Brussels. Between the Orkneys, which appear to be the nearest station to the north-west centre of oscillation, and Brussels, the greatest decrease of oscillation occurs. This line of the greatest diminution of oscillation appears to be well determined. The author closed his report with an allusion to the American system of atmospheric waves, especially those that accompanied the great Cuba hurricane of October 1844, which has formed the subject of an elaborate investigation by Mr. W. C. Redfield, of New York.

Electrical Science.

ELECTRICITY AND TERRESTRIAL MAGNETISM.

A PAPER has been read to the British Association, "On the Electric Currents by which the Phenomena of Terrestrial Magnetism may be be produced," by Prof. Thomson.

It is a well-known theorem, first demonstrated by Green, that the action of a mass of any nature, in attracting an external point, may be represented by means of a distribution of matter of the same kind over the surface of the body; that is to say, that a certain distribution of matter over the surface of a body may be determined, which will produce exactly the same force, whether of gravitation, of magnetism, or of electricity, as results from the body itself. Thus, by applying this theorem to the case in which the force considered is that of terrestrial magnetism, we see that a certain distribution of imaginary magnetic matter may be found, which would produce all the phenomena of terrestrial magnetism observed at the surface of the earth or above it, except those which are due to atmospheric or external sources of magnetism, if any such exist. This proposition, although of great theoretical interest, cannot be entertained as expressing a physical fact; for there are only two ways in which we can conceive internal sources of terrestrial magnetism to exist. We may either imagine, as Gilbert did, the earth to be wholly or in part a magnet, such as a magnet of steel, or we may conceive it to be an electro-magnet, with or without a core susceptible of induced magnetism. In the present state of our knowledge, this second hypothesis seems to be the more probable; and, indeed, we have now many reasons for believing that the existence of terrestrial electric currents, producing wholly or in part the magnetic phenomena, is a physical fact.

Connected with this, it becomes an interesting question, whether mere electric currents could produce the actual phenomena observed. Ampère's electro-magnetic theory leads us to an affirmative answer, but an answer which must be regarded as merely theoretical; for it is absolutely impossible to conceive of the currents which he describes round the molecules of matter, as having a physical existence. The idea of an electro-magnet is what naturally presents itself, when we endeavour to imagine a possible electrical theory of terrestrial magnetism, and the question which now occurs, is this,—Can the magnetic phenomena at the earth's surface and above it be produced by an internal distribution of closed galvanic currents, occupying a certain limited space below the surface? The answer is, that whatever be the form and magnetic contents of the earth, the same force as that which it exerts upon any exterior point may actually be produced by means of a distribution of closed electric currents on the surface.—*Athenæum*, Report, No. 1028.

MAGNETIC ATTRACTION OF MUD.

SIR A. MACKENZIE was the first to notice the attractive power of the Mud at the bottom of some of the lakes of North America, which is

sometimes so great that boats can with difficulty proceed along the surface. This extraordinary fact is thus stated:—"At the portage or carrying-place of Matress, on Rose Lake, the water is only 3 feet or 4 feet deep, and the bottom is muddy. I have often plunged into it a pole 12 feet long, with as much ease as if I merely plunged it into the water. Nevertheless, this mud has a sort of magnetic effect on the boats, which is such that the paddles can with difficulty urge them on. This effect is not perceptible on the south side of the lake, where the water is deep, but it is more and more sensible as you approach the opposite shore. I have been assured that loaded boats have often been in danger of sinking, and could only be extracted by being towed by lighter boats. As for myself, I had never been in danger of foundering; but I have several times had great difficulty in passing the spot with six stout rowers, whose efforts could scarcely overcome the attraction of the mud. A similar phenomenon is observed on the Lake Sagina, where it is with difficulty that a loaded boat can be made to advance, but fortunately the spot is only 400 yards over." This statement has since received confirmation from Captain Back and others, during the Arctic Land Expedition.

ANIMAL ELECTRICITY.

Sir R. H. Inglis, the President, in his address to the British Association, observes: in Physiology, the most remarkable of the discoveries, or rather improvements of previous discoveries, which the year 1846-7 has seen, is, perhaps, that connected with the labours of the distinguished Tuscan philosopher, Matteucci, who on several former occasions has co-operated with the British Association in the sections devoted to the advancement of the physical and physiological sciences. I refer in this instance to his experiments on the generation of electric currents by muscular contraction in the living body.* This subject he has continued to pursue; and, by the happy combination of the rigorous methods of physical experiment with the ordinary course of physiological research, Prof. Matteucci has fully established the important fact of the existence of an electrical current—feeble, indeed, and such as could only be made manifest by his own delicate galvanoscope—between the deep and the superficial parts of a muscle. Such electric currents pervade every muscle in every species of animal which has been the subject of experiment; and may, therefore, be inferred to be a general phenomenon of living bodies. Even after life has been extinguished by violence, these currents continue for a short time; but they cease more speedily in the muscles of the warm-blooded than in those of the cold-blooded animals. The Association will find his own exposition of the physiological action of the electric current, in his work, *Leçons sur les Phénomènes Physiques des Corps Vivants*, 1847.

The delicate experiments of Matteucci on the Torpedo agree with those made by our own Faraday upon the *Gymnotus electricus*, in proving that the shocks communicated by those fishes are due to electric currents generated by peculiar electric organs, which owe their most immediate

* See the *Resumé* of Prof. Matteucci's Researches in Electro-Physiology, presented to the Association at the meeting of 1846, in the Year-book of Facts, 1847, p. 148.

and powerful stimulus to the action of the nerves. In both species of fishes, the electricity generated by the action of their peculiar organized batteries—besides its benumbing and stunning effects on living animals—renders the needle magnetic, decomposes chemical compounds, emits the spark, and, in short, exercises all the other known powers of the ordinary electricity developed in inorganic matter, or by the artificial apparatus of the laboratory.

RESEARCHES ON THE VOLTAIC ARC.

M. Auguste De la Rue has communicated to the Royal Society, a paper of "Researches on the Voltaic Arc, and on the influence which Magnetism exerts both on this Arc and on bodies transmitting interrupted Electric Currents." The paper will be found entire in the *Philosophical Transactions* for 1847, Part I. In conclusion, the author observes:

"It may, perhaps, be thought that in the experiments I have just described, the sounds are produced by the mechanical action of attraction or repulsion exerted by the electric magnet on the substance traversed by an interrupted current; and that, consequently, magnetism has no more share in the phenomenon than a finger might be supposed to have, when pressing on a sonorous cord. The simple description of the experiments shows this interpretation to be inadmissible. In the first place, the sound is the same with the wires in a helix, whether these wires be stretched or not, or whether they be of lead, platinum, or brass. Besides, how could this account for the sound produced in large masses, especially in liquids, such as mercury, and for the fact, that the position of the conductor traversed by the interrupted current with regard to the poles of the electro-magnet does not exert any influence on the phenomenon? Further, it must be remarked that the sound in question is not a musical sound, such as would be produced by a string or mass made to vibrate by a cause acting exteriorly at its surface; it is a series of sounds corresponding exactly to the alterations of the passage of the current; like a species of collision of the particles amongst themselves. Thus, the phenomenon is molecular; and it leads to the demonstration of two important principles.

"The first principle is, that the passage of the electric current modifies, even in solid bodies, the arrangement of the particles; a principle which I have already deduced from the experiments contained in my preceding memoir on this subject. The second principle is, that the action of magnetism, under whatever form it may be exerted, modifies alike the molecular constitution of all bodies, and that this modification lasts as long as the cause producing it endures, and only ceases with it. What is the nature of these two modifications? This is what we must endeavour to investigate and to ascertain. I purpose to engage in this inquiry, and indeed I have already made some attempts, of which it would, however, be premature to give any account. I shall confine myself at present to a single remark, which does not appear to me to be devoid of interest: it is, that the influence of magnetism on all conducting bodies seems to impress on them, as long as it lasts, a molecular constitution similar to that which iron, and generally all bodies susceptible of magnetism, possess

naturally; for it developes in them the property of producing, when traversed by interrupted currents, sounds identical with those emitted also by iron and other magnetic bodies when transmitting these currents, but produced in these last without requiring the action of a magnet.

ORIGIN OF THE VOLTAIC CURRENT.

Prof. Majorchi has communicated to the *Philosophical Magazine*, No. 199, a paper of "Observations and Experiments respecting the Origin of the Voltaic Current." The Professor's main purpose is to examine the conditions necessary in the pile to the generation of the currents, which is quite distinct from the simple electrical disturbance in the fundamental experiments of Volta. We have not space for Prof. Majorchi's experimental details, but quote his conclusions:—

"From all that we have said, it would follow that, with a single force, mechanical, chemical, or physical, there is only an electrical disturbance, or the phenomena of statical electricity: thus the mechanical action of friction produces in the ordinary machine a simple disturbance of electricity; the chemical action of an acid solution on a metal gives signs of electrical disturbance on the condenser; the physical force of magnetism produces by induction an instantaneous disturbance in the natural electrical fluid of a metallic wire, without setting it in a continuous current. But when two forces are in action, one of which is capable of disturbing the natural electricity of the ponderable matter, and the other of evolving it from the integrant molecules of the same, that fluid may be set into a continuous current in a complete circuit. Notwithstanding the appearance of truth in this mode of explaining the phenomenon of the continuous electric current, there are some facts which merit a deeper investigation, aided by experiment, before assigning it as the just cause of this phenomenon. A voltaic pair composed of two different metals, for example, gives an electric current in a given direction when it is immersed in one liquid, and the direction may be inverted when another different liquid is substituted for the first."

GALVANIC CONNEXION.

A paper has on this subject been read to the British Association by Mr. Harper. All who are familiar with voltaic batteries have experienced the inconvenience of connecting the positive and negative poles with other instruments,—and when several batteries are employed, of connecting one to another, in consequence of the stubbornness of the wires commonly used, and the time taken up in arranging the binding screws and wires. In order to obviate much of this inconvenience, Mr. Harper submits a method which he has successfully adopted. It is by using a thin wire spirally formed, at each end of which is a helix of three or four turns; which helices being slipped on a piece of brass soldered, or fixed by a screw, to the battery or other instrument. This has been found a sufficient contact in every case in which it has been tried. By this method balls of wood have been covered with copper in the electrotype process for knobs of Leyden jars, &c.

IMPROVED BATTERY.

Mr. S. B. Swan, of Rochester, U.S., has discovered a new solution, or exciting liquid, for the Galvanic Battery, which promises to be of great utility to telegraph companies, as it is a saving of 75 per cent. in the materials employed, besides a large amount of labour and attention. The improvement consists in furnishing an exciting liquid, which produces an electric and galvanic current of uniform power and intensity, without the rapid decomposition of the metals and acids heretofore supposed unavoidable. This solution does not act chemically on the mercurial amalgam, and without trifling action on the zinc, indeed so as to be scarcely perceptible. Mr. Barnes, a telegraph operator, has used this solution for forty-five days, without alteration, no fresh amalgam or acids having been required except to supply the ordinary evaporation, nor any perceptible destruction of mercury or zinc perceived; during which time the battery has been in constant and efficient action.—*Patent Journal*, No. 43.

We may here mention, that the priority of the invention of the Electric Telegraph, has been placed in a new light by a correspondent of *The Builder*, who states, that the fact of an electric current being made to pass through a continuous wire of great length, was established about 100 years ago. "All the electric telegraphs are merely varied applications of it. The only real inventions are, probably, the application of it to printing at a distance, and the applying it by one wire to many stations. Heighton's application of the gold-leaf electrometer, instead of the magnetic needle, can scarcely be called an invention; and the one-wired telegraph used at Baden-Baden appears to be that of Brett and Little, in Furnival's Inn. The fact of the transmission of the electric current to great distances, was proved by Dr. Watson and friends on the 14th of July, 1747. They conveyed the shock across the Thames at Westminster on the 14th of August; they conveyed it a circuit of four miles, two of water and two of dry ground; its velocity was so great that no time appeared to elapse during its passage."

NEW AND CHEAP VOLTAIC BATTERY.

The Rev. N. J. Cullan, Professor of Natural Philosophy in the Royal College, Maynooth, has communicated to the *Philosophical Magazine*, No. 206, a paper on what he terms "a new Voltaic Battery, cheap in its construction and use, and more powerful than any battery yet made; also, on a cheap substitute for the nitric acid of Grove's Platina Battery." We have only space to quote the Reverend Professor's results:—

"From the experiments which have been described, I infer, first, that a battery superior in power to Professor Grove's nitric acid battery may be made by substituting platinized platina or lead for platina, and nitrosulphuric acid and nitrate of potash for nitric and sulphuric acid; and secondly, that a battery equal in power to the nitric acid battery may be constructed by the substitution of cast iron for platina.

"The advantage of what I may call the nitre platina battery over the nitric acid one is, that the expense of working the former is, as has been already stated, considerably less than that of working the latter.

"The advantage of the cast iron or platinized leaden batteries over

Professor Grove's is, that they are far less expensive in their construction. A plate of cast iron or platinized lead may be had for a shilling, whilst a platina plate of the same size will cost nearly three pounds. Besides, a cast iron or platinized lead battery may be worked by a mixture of nitre and sulphuric acid for one hour for about the tenth part of the expense of working a Grove's battery for the same time.

"The cheapness of cast iron and platinized lead will enable every one to procure a powerful voltaic battery. A platinized lead battery is about fifteen times as powerful as a common Wollaston battery of the same size. A cast iron battery is a little less powerful than the platinized lead one; but I prefer the former, because the cast iron does not require to be chromed or platinized."

REABSORPTION OF THE MIXED GASES IN A VOLTAMETER.

Professor M. H. Jacobi, states, in a letter to Michael Faraday, Esq., F.R.S., he has found, that if the Mixed Gases developed from the decomposition of water by a voltaic current, be allowed to remain in the Voltameter in which they were collected, in contact with the fluid which produced them, they by degrees diminish in volume, and ultimately disappear by being absorbed by the fluid. He has not yet fully determined the precise conditions on which this phenomenon depends; but he is inclined to think that it is owing to a portion of the mixed gases, diffused throughout the whole liquid, coming into contact with the platinum plates, and being recombined on the surface of those plates; and this process being renewed with every fresh portion of the gases which takes the place of the former, the whole of the gases are thus reconverted into water.

ELECTRICAL IMAGES.

Prof. Thomson has communicated to the British Association, a paper on "the principle of Electrical Images," which is suggested by Green's elementary propositions, as the proper way of treating a great variety of problems that present themselves with reference to the distribution of electricity on spherical conductors. The effect of a body electrified in any given manner upon an uninsulated sphere was shown to be completely represented by what may be called "the image of the electrified body in the sphere," and a simple geometrical construction was given by which this image may be described. When an electrified body is placed in the neighbourhood of the uninsulated spheres, an inductive effect is produced which may be represented by an infinite series of "successive images," in each sphere. An algebraic expression of this result leads to solutions, by means of converging series, of the various problems which occur with reference to the distribution of the induced electricity and the attractions exerted by the two spheres. When a single conductor, bounded by segments of two spherical surfaces cutting at an angle which is a submultiple of two right angles, is electrified by the influence of a charged body, the effect may be represented by means of a finite number of images disposed in a symmetrical manner in the circumference of a circle passing through the exciting body, and cutting the two spherical surfaces at right angles. The principle of electrical images, as applied in those two cases, may be illustrated by reference to the successive images of a candle placed

between two parallel plane mirrors, and to the symmetrically arranged images which are seen in the kaleidoscope.—*Athenæum*, No. 1029.*

POTASSIUM BATTERY.

Mr. Goodman has detailed to the British Association, the following:—

It was anticipated that the Metal Potassium, which could not possibly be retained *in situ* in contact with acidulated water, might nevertheless, by its amazing affinity for the oxygen of water, like the protoxide of iron in the pulmonary vessels, actually absorb oxygen through the substance of a tissue or membrane; and that by this arrangement its excessive action might be moderated, and itself retained in constant apposition with the absorbing membrane. A glass tube was accordingly obtained, the lower end of which was closed by a membrane of "turkey's craw." The amalgamated potassium (about half a grain) was fastened to the extremity of a piece of copper-wire, and plunged into the tube, already filled with Persian mineral naphtha, which, containing no oxygen, does not act upon potassium. The lower part of this tube and membrane were inserted in a solution of sulphate of copper in a wine-glass, below which was previously secured a small plate of platinum, also soldered to the extremity of a copper wire, and the whole were fixed by appropriate apparatus. Thus could the potassium at pleasure be lowered to the surface of the membrane, in which situation it would develope a current of 45° to 50°, when a galvanometer was introduced between, and connected with, the copper wires aforementioned, or it could be elevated into the mineral naphtha, and kept there suspended would remain perfectly quiescent. With this single voltaic pair the decomposition of water is performed with facility, as well as the solutions of metallic salts, sulphate of copper, &c.

In comparing the powers of this arrangement with those of zinc and copper, or bismuth and nitric acid, in which plates of considerably larger dimensions were employed, it was found that their influence upon the magnetic needle was greater in the proportion of 61° and 67½° to 50°, but no decomposition could possibly be obtained by either of the latter.

To test the powers of the Potassium Battery in producing the development of "high tension," an arrangement of twelve pairs was constructed, and a small piece of gold leaf was by it readily deflected above $\frac{1}{10}$ of an inch. Six pairs in excellent order deflected the gold leaf $\frac{1}{11}$ of an inch. All the intermediate numbers produced corresponding deflections; and finally, as measured by a micrometer screw, two pairs induced the deflection of $\frac{1}{12}$ of $\frac{1}{22}$ inch. And with one pair the gold leaf was sensibly drawn to the disc employed at $\frac{1}{44}$ of an inch.—*Literary Gazette*, No. 1591.

NEW GALVANOMETER.

Mr. Ward has exhibited to the British Association, a new Galvanometer, in which the current is measured by the deflexion of the conducting wire by a permanent magnet. The coil of the wire being placed permanently over the poles of the magnet, is free to move; and as the

* For M. Reiss' researches on "Electrical Figures and Images," see Yearbook of Facts, 1847, p. 153.

current is more or less powerful, the coil requires a greater or less weight to bring it to its original position: hence the force of the current is expressed in grains instead of in degrees.

LIGHTING BY ELECTRICITY.

At a late meeting of the Literary and Philosophical Society of Cumberland, the great attraction of the evening was an exhibition of a new mode of Lighting by Electricity, patented by Mr. Staite. "The light," says the *Newcastle Guardian*, "which was of astonishing brilliance and beauty, was placed under an air-tight glass vase. When the gas was turned down, it sufficiently lighted the spacious building, and bore the closest resemblance to the great orb of day of any light which we ever witnessed. The electric light was afterwards exhibited in a vessel of water with equal success. Mr. Staite explained that this light is economical as well as beautiful—the cheapest as well as the best, for all practical purposes. The inventor contemplates the application of his invention to several purposes, amongst which are telegraphing by flashes through coloured media, and the instantaneous display of night-signals of the usual colours for danger, caution, &c., at the required distances from the stations. Hermetically sealed, of course, under a glass, as long since suggested, this light would also be a great boon to miners."

In a lecture afterwards delivered, Mr. Staite gave the following comparative statement of the expense of the electric light, as compared with other modes of lighting:—

"With a battery consisting of forty small cells in series, the light was equal to 380 tallow candles, 300 wax candles, or 64 cubic feet of gas, this being effected by the consumption of little more than three-quarters of a pound of zinc per hour. The relative cost was by the electric light 1d., gas 6d. to 8d., tallow candles 7s. 6d., and wax candles 12s. 6d. per hour—so that there was no light so cheap, as well as none which exhibits such pure and brilliant results."

The apparatus, we believe, differs from "Greener and Staite's Patent Electric Lamp," described in the *Year-book of Facts*, 1347, p. 161.

SMELTING BY ELECTRICITY.

The lately patented process of Smelting Copper by means of Electricity, says a London journal, is likely to effect a change that will be quite prodigious. It produces, in less than two days, what the old process required three weeks to effect. And the saving of fuel is so vast, that in Swansea alone, the smelters estimate their annual saving in coals at no less than five hundred thousand pounds. Hence it is clear that the price of copper must be so enormously reduced, as to bring it into use for a variety of purposes from which its cost at present excludes it. The facility and cheapness of the process, too, will enable the ore to be largely smelted on the spot. The Cornish mine proprietors are anxiously expecting the moment when they can bring the ore which lay in the mine yesterday into a state to be sent to market to-morrow, and this at the very mouth of the mine. In Australia, also, the operation of this discovery will be of the utmost importance. Ten thousand tons of copper ore were sent from Australia to England last year, to be smelted at

Swansea; and the result was only 1,600 tons of copper. But Australia in future will smelt her own copper, by a 36 hours' process: saving all this useless freight of the 8,400 tons of refuse, and saving also the cost of the old and expensive process. In a very few years, Australia will send to market more copper than is now produced by all the rest of the world. But if our future penny-pieces are to bear any proportion to the reduced cost of the value of the metal, they must be made of the size of dinner-plates!—*Athenæum*, No. 1018.

NEW ELECTRICAL EXPERIMENTS.

Professor Henry, of Princeton, has communicated to the American Philosophical Society, the results of a series of Experiments on Electricity, having reference, first, to the discharge of electricity through a long wire, connected with the earth at the farther end; secondly, to the discharge of a jar through a wire; and, thirdly, to an attempt to account for the phenomena of dynamic induction.

Prof. Henry first showed, that when a charge of electricity is given to one end of a wire, the different parts of the wire become charged successively, as though a wave of electricity passed along it. He then showed that the charge passed along the surface of the wire, and not through its whole mass, as was supposed from the analogy of galvanic conduction. Hence he inferred that dynamical electricity obeys the same laws as the statical. He next detailed some experiments upon the passage of electricity through plates, and showed that when a charge was transmitted across a plate, the tension was greatest at the edges, the electricity apparently exercising a self-repelling action; while, if the charge were passed through two pieces of tinfoil, these slips attracted each other.

The author believes it may be justly inferred, from these experiments, that the attraction is due to ponderable matter, while the repulsion is due to electricity; thus showing that electricity is a separate principle, and not a mere property of matter.

Prof. Henry next passed to the subject of the discharge of a jar. It was necessary, in his experiments, to get rid of the free electricity arising from the thickness of the glass, and it occurred to him that this might be done by removing the knob, and making the coating upon the inside of less area than that upon the outside. With this arrangement, when the discharge was made through a long wire, and a test jar brought near it during discharge, a bright spark passed; but upon approaching the jar to a delicate electrometer, it gave no indications of free electricity. Reflecting upon this, and upon an experiment of Prof. Wheatstone, he was led to believe that the jar is discharged by two waves, a negative and a positive one, starting simultaneously from the two ends of the wire. To prove this, he broke the wire, and interposed a pane of glass dusted with red lead and sulphur; two figures of positive and negative electricity were produced. He made several other experiments tending to prove this same fact. He showed how these experiments serve to explain that of Dr. Priestley, where a spark was found to pass between the ends of a long bent wire, the ends being brought within a few inches of each other.

He next passed to the connection between statical and dynamical induction. Statical induction has heretofore only been observed at short distances. Prof. Henry's first experiment proved that it could be observed at the distance of nineteen feet, the floor of a chamber intervening, showing that statical induction takes place at great distances, though not at so great distances as the dynamical. He then explained his views of the nature of dynamical induction. When a spark is thrown upon a wire, it passes in a wave, whose length might be determined if we knew the velocity of electricity; now, if we have another parallel wire, a negative wave will be formed in this, and the two waves will travel simultaneously in the same direction. But this is equivalent to a positive induced wave in the opposite direction. In this way, the phenomena accompanying the discharge of a jar are easily explained. Again, if we conceive that in a galvanic battery the discharge consists of a series of such waves, we may very simply explain the phenomena of galvanic induction.—*Philosophical Magazine*, No. 202.

ELECTRICAL RAILWAY.

In the *New York Literary World*, we find quoted from the *Pittsburgh Journal*, a machine invented by a Mr. Lilly and Dr. Cotton, of that city. It is a small locomotive, and is placed upon a circular Railroad, around which it is driven by Electricity. The power is applied, not to the locomotive, but to the track, and herein consists the novelty of the invention or discovery. Two currents of electricity, negative and positive, are applied to the rails, and from thence communicate with the engine. The latter is provided with two magnets, which, by a process of alternate attraction and repulsion, drive the car over the track. A piece of lead was placed on the locomotive, making in all a weight of about ten pounds, and on the application of the battery the machine moved with astonishing rapidity up a plane inclined about five degrees. Heretofore, the propelling power has been used on the car itself; in this instance, however, the power is in the rails, and an engineer might remain in one town, and with his battery send a locomotive and train to any distance required.

PRESENCE OF SULPHUR IN METALLIC SUBSTANCES STRUCK BY LIGHTNING.

On Sunday, the 14th of June, 1846, the parish church of St. Thibaud-de-Couz, three leagues from Chamberry, was struck by lightning; when the church was filled with a dense smoke, accompanied by a strong smell resembling that of gunpowder. The gilt frame of a large picture was almost entirely blackened, and six gilt chandeliers were all rendered as black as copper would be after long exposure to sulphuretted hydrogen.

M. Bonjean procured some powder by scraping the surface of the chandeliers which had been most strongly coloured; by treating it with aqua regia he obtained a solution in which solution of nitrate of barytes gave a white precipitate insoluble in nitric acid.—*Journal de Pharm. et de Chimie.*

A BALLOON IN A THUNDER-STORM.

A CORRESPONDENT of the *Times* communicates to that paper a letter from Mr. George Green, the aeronaut, in which he gives some interesting particulars of an ascent at Frankfort "The weather," he says, "has been very unsettled and strong, and I have had only three fine days out of nine; the last, however (Sunday, August 22), was the worst of all—the wind blew almost a hurricane from the S.W., accompanied by heavy thunder and lightning nearly the whole of the day; indeed, it was generally believed the ascent would be postponed; but being anxious to keep up my reputation, I commenced the inflation. The ascent, which took place at a quarter to five, excited great alarm and astonishment, because just after a violent peal of thunder the balloon rose almost immediately under the clouds from which the storm proceeded. When at about four thousand five hundred feet high, and on a level with them, several electrical discharges occurred, which afforded me the long-wished-for opportunity of observing the effect of lightning upon the air,—as the clouds and the balloon were going abreast of each other at only a few hundred yards distance. The air was very much disturbed; it seemed full of eddies, which agitated the balloon a good deal. Every fresh discharge communicated a vibrating motion to the balloon, and caused it to oscillate considerably; while the rain falling on the earth made a noise like a waterfall at a great distance. In descending, we fell in with a current blowing a few points more to the north,—which bore us away from the storm: and after being up about an hour, I descended at Windeeken."

LONGITUDE BY THE MAGNETIC TELEGRAPH.

WE find in a New York paper the following interesting account given of the results of certain experiments recently made in America, for the determination of the difference of Longitude between three of its principal cities, New York, Philadelphia, and Washington, by means of the Magnetic Telegraph* :—

The observations at the Washington Observatory were made by Professor Keith, those at Philadelphia by Mr. S. C. Walker, and those at Jersey City by Prof. Loomis. These three observatories were connected by a continuous wire; so that telegraphic signals might be exchanged between any two of them at pleasure. In some of the first experiments, signals were exchanged between Jersey City and Philadelphia, and also between Philadelphia and Washington; but it was found impossible to transmit signals directly from Jersey City to Washington. The power of the battery appeared inadequate to that distance. But on the 29th of July this difficulty was overcome. Twenty clock signals were given at Jersey City, and recorded both at Philadelphia and Washington; twenty signals were given at Philadelphia, which were received at Jersey City and Washington; and twenty signals given at Washington were received at Jersey City and Philadelphia. Thus the comparison of the three clocks was perfect.

The difference of longitude between Jersey City and Philadelphia is four minutes and thirty seconds; and between Jersey City and Washington, twelve minutes and three seconds; omitting in each case a fraction of a second which can only be fully determined when all the observations have been completely reduced.

These experiments furnish the means of measuring the velocity of the elec-

* Athenæum, No. 1038.

tric fluid; provided the time employed in its passage from Jersey City to Washington is not too small to be appreciated. Suppose the difference of longitude between the two places is exactly twelve minutes. Accordingly, when it is ten o'clock at Washington, it will be twelve minutes past ten at Jersey City. Let now a telegraphic signal be given from Jersey City. If that signal is heard at the same instant at Washington, then the Washington clock should indicate exactly ten hours. But if it require one second for the signal to travel to Washington, then upon its arrival the Washington clock will indicate ten hours and one second; that is, according to this comparison, the difference between the Jersey City and Washington clocks will appear to be eleven minutes and fifty-nine seconds. Suppose again, that at ten o'clock a signal be given from Washington. If that signal be heard at the same instant at Jersey City, then the Jersey City clock should indicate exactly twelve minutes past ten; but if it require one second for the signal to travel from Washington to Jersey City, then upon its arrival the Jersey City clock should indicate ten hours twelve minutes and one second; that is, according to this comparison, the difference between the two clocks appears to be twelve minutes and one second. The two comparisons differ by two seconds, or twice the time required for the signal to travel from Jersey City to Washington. Now, whatever may be the time required for the transmission of a signal, the difference between the two modes of comparing the clocks should amount to twice that interval, and the longitude derived from signals transmitted from Jersey City to Washington should be less than that derived from signals transmitted from Washington to Jersey City.

What now is the result of the experiments actually made? The longitudes derived from the two modes of comparing the clocks do really differ. The difference amounts in some cases to one-third of a second. But, strange as it may appear, this difference is in the wrong direction. The longitude derived from signals transmitted from Jersey City to Washington is greater than that derived from signals transmitted from Washington to Jersey City. The conclusion seems to follow that a telegraphic signal is transmitted more than two hundred miles in less than no time. Observe that we now speak of absolute, not local time; for it is not doubted that a signal made at Jersey City at ten o'clock will reach Washington long before ten according to Washington time. But the observations seem to indicate that a signal from Jersey City is heard at Washington before it is made at Jersey City; and also that a signal from Washington is heard at Jersey City before it is made at Washington. Such a conclusion will suit poetry better than science. It seems probable that the difference in question arises from the difficulty of estimating minute fractions of a second. This is indicated by the fact, that, on one evening, the Jersey City and Philadelphia clocks were found to tick together; and the signals being given coincident with the beats of one clock, the times of arrival coincided with the beats of the other clock. Thus there was no fraction of a second for the ear to estimate, and the two modes of comparing the clocks gave identical results. On several evenings the discrepancy in the observations amounted to about one third of a second; and if we suppose each observer to err in his estimates by one-sixth of a second, the difference is explained; only we must admit that each observer, upon the arrival of a clock signal, estimates the time one-sixth of a second too soon; which seems to indicate that the signal is heard at a distant station before it is really made.

That this hypothesis is not without foundation has been verified in the following manner:—The three observers, Messrs. Loomis, Walker, and Keith, have met at Jersey City, and compared their methods of observation; more especially their modes of estimating fractions of a second. This was done by comparing solar time with sidereal time. The solar day is about four minutes longer than the sidereal; and a sidereal clock will therefore gain upon a solar clock, one second in about six minutes. A series of signals was transmitted from Jersey City to Philadelphia, at intervals of ten seconds; coincident with the beats of a solar clock, and the times recorded by Professor Kendall at Philadelphia upon a sidereal clock. The times were all recorded at Jersey City by a sidereal clock. These signals were continued for ten minutes, during which time the sidereal clock had gained more than one second upon the solar. The signals being all given coincident with the beats of a solar clock,

the fractions of a second estimated upon the sidereal clock go on continually increasing, and pass through every possible value in about six minutes. In a period of ten minutes, the clock-beats must twice coincide. Now the ear can judge of a coincidence of beats with almost absolute precision; and having determined the instants when the beats coincide, we can easily compute what fraction ought to have been estimated upon the sidereal clock at each signal from the solar clock. Thus we obtain the error of each estimate of time on the sidereal clock. A similar set of signals was given at Philadelphia from a solar clock, and received at Jersey City upon a sidereal clock. The result of these trials was to detect a small error in the estimation of fractions of a second; and such as will explain in part, if not wholly, the discrepancy of the observations.

One important conclusion is deducible from these experiments, viz., that by means of the magnetic telegraph, a clock in New York can be compared with another at a distance of two hundred miles quite as accurately as two clocks can be compared in adjoining rooms. Another conclusion which appears to be authorized by these experiments is, that the time required for the electric fluid to travel from New York to Washington and back again, a distance of 450 miles, is so small a fraction of a second, that it is inappreciable to the most practised observer.

INDUCTION OF ATMOSPHERIC ELECTRICITY ON THE WIRES OF THE ELECTRIC TELEGRAPH.

Prof. Draper has communicated to the American Philosophical Society, a paper on the Action of the Electricity of the Atmosphere on the Wires of the Electrical Telegraph, at the present time a subject of much importance, both on account of its practical bearing, and the number of purely scientific questions which it involves. The paper contains a number of facts in reference to the action in question, which fill half a dozen pages of the *Philosophical Magazine*, No. 200. We have only space to quote the preventives, proposed by the learned Professor.

"The effects of the powerful discharges from the clouds may be prevented in a great degree, by erecting at intervals along the line, and aside of the supporting poles, a metallic wire, connected with the earth at the lower end, and terminating above at the distance of about half an inch from the wire of the telegraph. By this arrangement, the insulation of the conductor will not be interfered with, while the greater portion of the charge will be drawn off. I think this precaution of great importance at places where the line crosses a river, and is supported on high poles; also in the vicinity of the office of the telegraph, where a discharge, falling on the wire near the station, might send a current into the house of sufficient quantity to produce serious accidents. The fact of Prof. Richman, of St. Petersburg, should be recollected, who was killed by a flash from a small wire, which entered his house from an elevated pole while he was experimenting on atmospheric electricity.

"The danger, however, which has been apprehended from the electricity leaving the wire and discharging itself into a person on the road, is, I think, very small; electricity of sufficient intensity to strike a person at the distance of eight or ten feet from the wire, would, in preference, be conducted down the nearest pole. It will, however, in all cases be most prudent to keep at a proper distance from the wire during the existence of a thunder-storm in the neighbourhood.

"It may be mentioned as an interesting fact, derived from two inde-

pendent sources of information, that large numbers of small birds have been seen suspended by the claws from the wire of the telegraph. They had, in all probability, been instantaneously killed, either by a direct discharge, or an induced current from a distant cloud, while they were resting on the wire.

"Though accidents to the operators, from the direct discharge, may be prevented by the method before mentioned, yet the effect on the machine cannot be entirely obviated; the residual current which escapes the discharge along the perpendicular wires, must neutralize for a moment the current of the battery, and produce irregularity of action in the apparatus.

"The direct discharge from the cloud on the wire is, comparatively, not a frequent occurrence, while the dynamic inductive influence must be a source of constant disturbance during the season of thunder-storms; and no other method presents itself to my mind at this time for obviating the effect, but that of increasing the size of the battery, and diminishing the sensibility of the magnet, so that at least the smaller induced currents may not be felt by the machine. It must be recollected that the inductive influence takes place at a distance through all bodies, conductors and non-ductors; and hence no coating that can be put upon the wire will prevent the formation of induced currents.

"I think it not improbable, since the earth has been made to act the part of the return conductor, that some means will be discovered for insulating the single wire beneath the surface of the earth; the difficulty in effecting this is by no means as great as that of insulating two wires, and preventing the current striking across from one to the other. A wire buried in the earth would be protected in most cases from the effect of a direct discharge; but the inductive influence would still be exerted, though perhaps in a less degree.

"The wires of the telegraph are too small and too few in number to affect, as some have supposed, the electrical condition of the atmosphere, by equalizing the quantity of the fluid in different places, and thus producing a less changeable state of the weather. The feeble currents of electricity which must be constantly passing along the wires of a long line, may, however, with proper study, be the means of discovering many interesting facts relative to the electrical state of the air over different regions."

CAUSE OF EVAPORATION, RAIN, HAILSTONES, &c.

Mr. Rowell has read to the British Association, a paper "On the Cause of Evaporation, Rain, Hailstones, and the Winds of Temperate Regions." The details of this communication are too long for quotation, but we may state briefly, that Mr. Rowell believes the theory of the mixing of masses of air at different temperatures to cause rain, totally fail in accounting for large rains. He connects all the meteorological phenomena included in the titles of his paper, with electricity. For instance, evaporation, rain, &c., he considers particles of water extremely minute coated with electricity, nearly the weight of air. If these particles become expanded by heat, their specific gravity will be changed, and their capacity for electricity in-

creased. They rise in the atmosphere, surcharged with electricity. By any reduction of electricity—by the hills, for example, not from condensation—clouds are formed; and any thing withdrawing the surcharge causes rain; the sudden equalisation of the electric particles, great storms. The artificial formation of rain by withdrawing electricity from a given locality of the atmosphere, he proposes as a practical test of his theory.

ELECTRO-TELEGRAPH INTERRUPTED BY ATMOSPHERIC ELECTRICITY.

THE following is from a letter from M. Breguet to M. Arago, translated for the *Mec anics' Magazine*:—

"About five o'clock in the afternoon, during a heavy fall of rain, the bells of the electric telegraph (placed in a little shed, at one end of the St. Germains Atmospheric Railway) began to ring, which led the attendant to suppose that he was about to receive a communication. Several letters then made their appearance, but finding they conveyed no meaning, he was about to make the signal "Not Understood," when, suddenly, he heard an explosion, similar to a loud pistol shot, and at the same time a vivid flash of light was seen to run along the conductors placed against the sides of the shed. These conductors (which vary in diameter from two-tenths to five-tenths of a millimètre) were broken into fragments, so hot, that they scorched the wooden tables on which they fell, and their edges presented evident traces of fusion. The wires of several electro-magnets, belonging to the apparatus placed in the shed, were also broken, and, at the same time, the attendant experienced himself a violent concussion which shook his whole frame.

"The shed at Le Vesinet, where the lightning occasioned these remarkable phenomena, is placed in connection with the Paris station, by wires supported on posts; yet at Paris nothing was broken, nothing remarkable occurred, excepting that several of the bells were heard to ring. But at about 200 mètres from La Vesinet, the top of one of the posts which support the wire was split; several splinters had flown off from it, and the side facing the railroad bore, from top to bottom, evident traces of the passage of the lightning.

"There are three of these wires between the Paris station and Le Vesinet; they rise vertically at right angles with the line of railway to the height of from six to seven mètres, and are then bent over into the horizontal direction, At the corners of the angles, three brushes (*aigrettes*) of light were observed several seconds after the explosion.

"At the time of the explosion, an attendant, who was holding the handle which moves a needle placed at a short distance from the extremity of the atmospheric railway, sustained all over the body a violent concussion, and several workmen, standing about him, also experienced severe shocks.

"In my opinion the explosion came from the railway; for, on account of the immense quantity of metal employed in its construction, and the extent of its surface, it is very probable that during a thunder storm it may be the seat of an intense electric tension, and that the fluid thus attracted may discharge itself on the telegraphic wires, which are not above three or four mètres distant from the iron rails, tubes, needles, &c.

" In order to protect the attendants from the consequences of such terrible, and it may be fatal explosions, and to prevent the destruction of the apparatuses, I think it would be advisable to stop the conducting wires (which are from three or four millimètres in diameter) at five or six mètres from the station, and to connect them with the telegraphic apparatus by a number of very fine wires; which being of very small section, could transmit only a small quantity of electric fluid to the station; and, should a discharge take place, the main wires would melt or break, not *within*, but *without* the premises occupied by the attendants on the telegraph."

NEW EFFECT OF THE MAGNETIC TELEGRAPH.

THE various wires of Telegraph beginning to intersect so many sections of our country are said to have a decided effect upon electricity. That eminently scientific man, Professor Olmstead, of Yale College, states, that as the storm comes up, and especially when over the wires, say 50 or 100 miles distant, the lightning is attracted by the wires:—which can be proved by any one remaining in the Telegraph Offices for half an hour. About the time the storm is coming, the wires are continually filled with electricity. " It is my opinion," he says, " that we shall never have very heavy thunder showers, or hear of lightning striking, so long as we have telegraph wires spread over the earth.—*American paper.*—According to this we should long ago have ceased in such a city as London to have any experience of such a thing as a thunder-storm; for what are all the telegraphic wires that have yet been erected, or that ever will be erected in any country in the world, to the prodigious quantity of iron rails and posts contained within any square mile of this vast aggregate of iron-fenced houses and streets? Professor Olmstead's ideas on this head are much at variance with those entertained by other men of science. Professor Leslie quite derides the idea of any non-conductor exerting an attractive influence at a distance of even fifty or a hundred *inches.*—*Editor of the Mechanics' Magazine.*

INSULATION OF TELEGRAPHIC SIGNAL POSTS.

MR. IRA CONNELL, of Ithica, N. Y., is the inventor of a very efficient contrivance for Insulating the Wires on Telegraphic Posts. By this invention, the fluid can never be carried to the earth in wet weather, as is frequently the case, to the great annoyance of the operation. The contrivance consists in giving to the lower part of the glass knob a bell-shape, and this resting on the wooden pin, so that the underside will always be perfectly dry. Another plan, by the same inventor, to effect this object, consists in an *iron* knob similarly shaped, but lined on the under side with glass, and a glass bush to pass the wire through; this latter knob cannot be very easily broken by stones being thrown at it. The knob has been introduced with perfect success on the Buffalo line, where communications of five hundred miles are as certainly and easily carried as if across the street.—*Eureka.*

BAIN'S NEW SYSTEM OF ELECTRO-TELEGRAPHIC COMMUNICATION.

MR. BAIN has patented certain improvements, which have for their first and main object, to obviate the waste of time which now attends

the making and breaking of contact by means of Electro-Magnets, and the employment of needles to indicate the letters of the alphabet, figures, &c. He describes various arrangements by which this may be effected, but they are all nearly similar in their general features—at least in so far as respects their elementary principles and the effect produced by them. (To give a distinct and clear view, however, of this specification, we are forced to depart somewhat from the order in which the various parts, &c., are described in the original.)

Each complete system of arrangements consists, of course, of a transmitting apparatus at one end of a line, and a recipient apparatus at the other, with a connecting wire, or wires, between them. First, is a thin roller of wood, upon which there is wound a long strip of paper, which has been previously perforated with holes. Each group of holes, as divided by the cross lines, represents some one or other of the letters of the alphabet, or some one or other of the usual numerals, or entire words or sentences, according as may previously be determined upon. From the roller the end of this slip of paper is passed between another roller and two metallic springs. The latter roller is composed of metal pieces, mounted upon wood inside, so that their two contiguous edges shall be some distance apart. Motion is communicated to this roller from clockwork, which is regulated as to its velocity by means of a ball-governor instead of a pendulum. The recipient apparatus at the opposite end of the line is in all respects the same as the transmitting one, except that instead of the strip of perforated paper there is wound upon the roller a strip of coloured paper, which has been first soaked in dilute sulphuric acid, and afterwards in a solution of prussiate of potash; and is so wound upon the first roller, while yet in a wet or damp state, in which state it forms a part of the voltaic circuit, and must therefore be kept while the communication is being transmitted. Matters being thus arranged, and the machines at both ends of the line being placed in metallic contact by means of a single wire passing between them, and the metallic springs being connected to a galvanic battery, the attendant on the transmitting apparatus sets it going, which has the immediate effect of lifting a detent in the recipient apparatus at the other end of the line, and thereby setting that going also; that is to say, the two machines commence unrolling simultaneously the strips of paper attached to them respectively. As long as contact is prevented between the springs and the second roller of the transmitting apparatus, by the interposition between them of the entire parts of the roll of paper, the passage of the voltaic circuit is interrupted or broken; but the instant that either of the springs comes over one, two, or more of the holes in the paper, the voltaic circuit is re-established; and the electric current flowing through these holes passes along the connecting wire and through the wet roll of paper of the recipient apparatus, discharging in its passage the colour from the paper (by the decomposition of the chemical substances employed in its preparation) in those parts which it penetrates, and thereby leaving as many legible spots on the wet roll of paper as there are holes in the dry. It follows, that by thus alternately breaking and renewing contact, and that as fast as this can be done, strokes or dots, corresponding to letters, numerals, &c., can be made on the recipient strip of paper.

When it is desirable that the attendant of the machine should not know the contents of the communication made, the recipient paper is to be wetted with dilute sulphuric acid, and then passed through the apparatus in the manner above described, after which the words can be rendered legible by immersing the paper in a solution of prussiate of potash.

Among various modifications of the preceding arrangements specified by Mr. Bain, the most noticeable is one in which a revolving disc is employed, in the periphery of which there are a number of metallic rods, or wires, of equal length, which may be made to slide out towards one side of the disc, or to the other, at pleasure.

Mr. Bain describes, finally, an improved method of constructing the posts for supporting the wire of communication. He proposes to make each post of several pieces of wood bound together by cast-iron hoops, intending thereby (apparently) to lessen the chance of the wires being affected from beneath by disturbing currents of electricity.

[From the description given of Mr. Bain's invention, it will be seen that the rapidity of communication by it, is limited by two circumstances only: first, the time required to punch out the holes in the roll of paper of the transmitting apparatus before committing to (may we not say ?) the press; and, second, the number of intermissions of the electric current which can be effected in any given time—one intermission being requisite for every letter, or sign. Now, the time required for the first part of the process must depend on the number of letters or signs which it is in the physical power of a clever hand to punch out in a given time, which can scarcely exceed, on the average, 100 a minute; but the passage of the electric fluid is so instantaneous (faster than lightning) that we make no doubt from 500 to 1000 intermissions in a minute may be readily effected in the way proposed by Mr. Bain. Supposing, therefore, a communication to be once punched out in paper, and the paper to be committed to the transmitting apparatus, it will require but a few minutes to convey that communication to any distance, however great; and that, too, in as complete a state as any letter, despatch, circular, or pamphlet is now conveyed bodily by post.—*Editor of Mechanics' Magazine.*

ELECTRIC TELEGRAPHS ON THE SOUTH-EASTERN RAILWAY.

Mr. C.V. Walker has read to the Royal Institution, a paper on these Telegraphs, the object of which was to put forth a mass of facts with which the public are not much acquainted, relating to the prominent position which Electric Telegraphs now occupy in this country, and the amount of work that is daily being executed by them. The South-Eastern lines were given as a good, perhaps the best, example of the full carrying out of the principles. After briefly pointing to the galvanometer, the electro-magnet, and the voltaic battery, as the three instruments chiefly employed, and describing the metals used as conductors, the particular battery adopted for working the telegraphs was explained: it is what is called an ordinary acid battery; it is a trough of 12 or 24 cells, with slate partitions, protected by marine glue, or other water-proof cement; the metals are copper and amalgamated zinc; the trough is filled with fine siliceous sand, which is moistened with acid water. With a little

attention these batteries last for several months. The only treatment to which the above batteries were subjected during the intervals given was the occasional addition of a little acid water; and in some cases the dirty surface was removed from the sand; and after pumping over to wash the remaining sand, fresh was placed in, and acid water added. Some of the batteries—at the tunnels, and at Folkestone—are very hard worked.

The following table shows the extent already laid by the Telegraph Company.

RAILWAY.	Length	No. of Wires.	Miles of Wire.	Weight of Wire in cwts	Loads of Timber.	No. of Instruments.			No. of Stations
						Single.	Double.	Bells.	
South-Western	99	4	396	396	297	—	10	10	5
South-Eastern	150	3 or 4	575	575	862	23	31	64	35
Blackwall	5	14	70	70	—	—	—	—	6
Eastern Counties	218	5 or 7	1255	1255	1276	—	55	60	45
Eastern Union	17	5	85	85	102	—	5	8	5
Norfolk	58	7 or 12	516	516	348	45	10	13	13
Wolverton & Peterborough	57	3	181	181	171	—	11	11	10
Midland Counties	209	3,5, or 7	1077	1077	1212	51	26	77	41
Bradford and Leeds	15	5	90	90	90	—	8	8	8
Manchester and Leeds	50	7	350	350	360	—	20	20	20
York and North Midland	23	5	115	115	138	9	3	5	8
Hull, Selby, and Midland Extension	40	5	200	200	240	—	6	6	6
York and Scarborough	43	3	129	129	258	—	5	5	5
Great North of England	64	2 or 7	333	333	324	13	6	19	13
Newcastle and Darlington	54	3 to 7	316	316	324	9	10	23	19
Preston and Wire	20	3	60	60	120	—	5	5	5
Sheffield and Manchester (Woodhead Tunnel)	3	2	6	6	—	2	—	2	2
Great Western	19	4	76	76	38	—	2	2	2
South Devon	20	4	80	80	120	5	6	11	6
London and Croydon	7	3	26	26	16	4	4	11	4
Hull and Bridlington	27	3	81	81	162	—	5	5	5
Totals	1198	—	6017	300 tons	6398	161	228	355	253
North British	58	5							
Litto, Haddington Branch	—	—							
Edinburgh and Dalkeith	1¾	2							

Mr. Walker stated, that complex and confused as the deflection of galvanometer needles may appear to the untutored eye, words and sentences are sent and received almost as quickly as they can be written down. He then mentioned that the instruments in question are erected by the Telegraph Company, established in June, 1846; that they were proprietors of these and other patents, which they had applied to some 1200 miles of railway in this country, as expressed in the Table on the preceding page.

With respect to the cost, it depends on the number of wires and weight of timber, and will vary from £80 to £250 per mile.—*Selected and abridged from the Literary Gazette*, No. 1585.

BRETT'S SUBTERRANEAN AND OCEANIC ELECTRIC PRINTING TELEGRAPH.

THE originator and patentee of the present Telegraph is Mr. Jacob Brett, of No. 2, Hanover Square, London; and from a telegraphic printed copy of a letter, so long ago as July, 1845, Mr. Brett, in conjunction with his brother, proposed to the Government to put the metropolis, by means of his Oceanic Telegraph Line, in immediate connexion with the various Colonial and Channel Islands. This line being combined with Mr. Brett's Patent Printing Telegraph, any communication could be instantly transmitted and delivered, in an unerring printed form, almost at the same instant of time, at the most distant part either of the United Kingdom or of the Colonies.

The indisputable advantages of Brett's Electric Printing Telegraph, for making rapid communications between distant places, either for Government, railway, or commercial purposes, are its great simplicity, certainty of action, and economy. As an evidence of its facility, we may state that the Machines for general purposes will *compose and print*, in a given time, as much matter as three or four first-rate compositors could set up in form ready (*only*) for printing; viz.—from 100 to 300 letters per minute; and by those Machines, adapted for special purposes by Mr. Brett's recent improvements, he can print from 300 to 3000 letters per minute. The following is a brief description of the Telegraph:—

Suppose at one extremity of *a single line* of Telegraphic wire, a small key-board, containing a row of ivory keys, marked with the letters of the alphabet, and other characters, or words; and that it be connected by the said wire to the Printing Machine at the other extremity. This Machine contains a type-wheel, having on its circumference corresponding letters, words, or signs; a slight electric power is sufficient to regulate the motion of the whole, so that the instant a key representing any particular word, letter, or sign, is pressed down by the person at the key-board at one end of the line, the corresponding word, letter, or sign of the type-wheel prints, and the signal-bells ring at the other end of the line of Telegraph, without limit as to distance. The communications are printed on paper supplied from a scroll of unlimited length, from which any portion of the correspondence may be cut off at pleasure.

The motive power is simple; it being that of a weight, which sets in motion the key-shaft and governor of the key-board; and the circuit-wheel in connection with the shaft being put in contact with the wire of

the galvanic battery, or other generator of electricity; according to the velocity of motion and manipulation at the key-board, so will the motion be fast or slow at the printing end of the Telegraph; the type-wheel of the Telegraph is set at liberty by means of an escapement, and weights in connexion with it, so as to print with a like velocity, in combination with an hydraulic or pneumatic regulator, which admits of the desired letter *only* being printed, by checking and releasing an eccentric arrangement; a rod from thence unites with the cylinder on which the paper is printed, in various modes, as may be desired, either in paragraphs—on a sheet of paper, upon a long strip of ribbon or paper; or, if for Government despatches, and the like, it can be printed line by line, like the column of a newspaper, of an unlimited length.

There is a separate key-board, of a circular form, from which communications can be forwarded to any or every station in connection with it, the letters, words, or characters, being arranged around it on the keys; and these, if depressed by the fingers, will check the motion of a pin, or shaft, and also of the circuit-wheel fixed to the same axis, at such given point or key, by which means the operator may make or break the circuit of conductors at such letter or point.

The distance actually proved to act by this Telegraph in one continuous line has been 230 miles, and 340 miles apart, at the rate of 100 letters per minute.

Among its exploits is the following:—"The message of the Governor to the legislature of New York, delivered at Albany on the 7th of January, and consisting of two columns and a half of solid nonpareil, was published in the city of New York two hours after its delivery, having been transmitted, sentence by sentence, by the Printing Telegraph."—*Abridged from the Illustrated London News*, No. 262, which see for two engravings explanatory of the Telegraph.

BRETT AND LITTLE'S ELECTRIC TELEGRAPH.

Messrs. Brett and Little, of Furnival's Inn, have patented ten improvements in the Electric Telegraph, which we shall describe briefly, as they have already been very extensively published. The claims of the patentees are as follow, from the specification; with explanations, by the Editor of the *Mechanics' Magazine*:—

1. The use of a Ring, or piece of metal, partially magnetized, in combination with a reel or coil of wire, whereby and wherein the electric current so acts, that the motions take place in a direction transverse to the axis of the coil, and parallel, or nearly so, to the planes in which the coil of wire lies. The electric fluid is made to pass through a number of coils of fine wire, covered with silk, or other non-conducting material; which wire is wound on a flat reel. The ends of these fine wires are alternately brought into contact with the galvanic battery, by suitable arrangements, whereby the current is made to act on and give motion to the partially magnetic ring, or piece of metal, suspended and moving on a fixed centre in a plane parallel to the side, or face, of the flat reel, about which the wire is coiled; that is to say, parallel to the planes in which the wire is so coiled; the motions of this parallel magnetized ring being communicated to an indicator, or indicators, whose motions in connexion with a peculiarly arranged dial-plate, with symbols thereon, may be employed to designate letters, figures, or other conventional signals, and transmit intelligence by means of electricity.

2. An Indicator, or Indicators, deriving motion respectively from a current of electricity transmitted through a coil arranged and acting on a partially magnetized ring or piece of metal, as above described.

3. The adaptation of an Inductor or Inductors to a dial-plate.

On this are two vertical columns containing numerals from 1 to 25. The centre of the plate is retained for the symbolic arrangement of letters and figures by which the whole of the letters of the alphabet can be designated. When the indicators are in a state of rest they are in an angular position; but when put in action they move to a position nearly vertical, but are prevented from passing the vertical line by a pendant bar. In transmitting a signal or signals, the letter or letters of the alphabet are designated by single or repeated motions of either of two indicators (right and left hand), or of both in conjunction. Thus the letter A which is placed opposite to fig. 1 is indicated by one motion of one left-hand indicator; the letter B which comes opposite to fig. 2 by two motions of the same indicator; the letter E by four motions, two left and two right; and so on.

4. The working two Indicators, so as to give the requisite motion by means of a single handle.

5. For giving audible Signals, the use of a Ring or piece of metal, partially magnetized in combination with a reel or coil of wire, as before described; whereby and wherein the electric current so acts that the motions take place in a direction transverse to the axis of the coil, and parallel, or nearly so, to the planes in which the wire, constituting the coil, lies, and actuate suitable apparatus for giving such audible signals.

A bell or gong is substituted for the dial-plate and inductors, and the signals expressed by striking one, two, or more successive blows on the bell or gong, which is effected by wheelwork.

6. The use of an Apparatus for conducting the atmospheric electricity to the earth, in which the two semi-spheres of the lightning-conductor, as usually constructed for that purpose, may be adjusted to or from each other, as circumstances may require.

In lightning-conductors, as ordinarily constructed, there are two metal plates, which are fixed to and kept apart by blocks of ivory, and two semi-spheres, which are made fast, one to each plate. The improvement here consists in making the semi-sphere fast to the plate (as usual), but attaching the other by a screw to the plate, "by which means, and by the aid of a regulating screw-nut, the semi-sphere of the metal may be brought either closer or farther distant from the semi-sphere as may be rendered necessary by the expansion or contraction of the instrument, or by other circumstances.

7. The Insulator, and stretching of the long circuit wires upon and by means of an insulator, of glass, earthenware, porcelain, or metal, bell-shaped in the interior, so as to prevent the rain establishing a circuit for the electricity from the wire to the support upon which the insulator is affixed, and so shaped on the exterior as to admit of a stretcher being applied at pleasure to stretch the long circuit wires from insulator to insulator.

8. A Deflector in combination with an earth-plate to each instrument, whereby the electric current may be diverted, and the instruments insulated in such manner as to allow the instruments at two or more stations on a long line to communicate with each other, independently of the other stations.

9. The use of the apparatus called "the Hydraulic Battery," in which the acid to the sand, or other retainer of moisture, is supplied from above, drop by drop, and escapes from below, drop by drop, so as thereby to keep up continuously a percolation through the sand, or other retainer of moisture, and, by such percolation, carry off the sulphate of zinc, and prevent its becoming crystallized on the plate; also, the said hydraulic battery, both as an improvement in the working of electric telegraphs, and as applicable to the working of time-keepers or clocks, where electricity is employed as a motive power, and for other purposes in which a steady uniform current of galvanic electricity is required.

10. For time-keepers, in which electricity is a moving power, the use of a Ring or piece of metal, partially magnetized, in combination with a reel or coil of wire, as above described.

As electric time-keepers require but a small power for keeping their pen-

dulums in motion, a sufficient current may be obtained from two series of any one kind of metal, (for which purpose zinc or iron is the most economical,) buried in the earth, and when zinc is used for the series, the supply of electricity may be augmented by surrounding one set of the plates of the series so employed with a solution of ammonia.

Of the precise meaning to be affixed to the term partially magnetized ring, used throughout this specification, no explanation is anywhere given.

Messrs. Brett and Little have published an elaborate description of their improvements, with illustrations.

WORKING OF THE ELECTRIC TELEGRAPH.

As an instance of the Working of the Electric Telegraph, we quote the following details of the Transmission of the Queen's Speech, on the opening of the New Parliament, on Tuesday, Nov. 23, 1847 :—

On this day, (states the announcement,) the Electric Telegraph was brought into active operation on a grand scale, for the purpose of transmitting the Queen's speech to the various large towns and cities throughout England and Scotland. An early copy of the speech, specially granted for the purpose, was expressed from Westminster to the central stations in the Strand and at Euston-square—both of which places it reached by half past one. The manipulators at these stations, having touched the wires,—communicating with every telegraph station throughout the kingdom, thereby sounding a bell at each, and giving the note of preparation—commenced throwing off in a continuous stream along the wires successive sentences of the speech. This operation occupied from a quarter past one to a quarter to three, on the principal lines of telegraph ; but considerably less, owing to the greater proficiency of the manipulators, on the Eastern Counties and South-Western. It was completed to Southampton, where a steamer was in readiness to express the speech to the continent, in about an hour. During the two hours the speech was transmitted over 1,300 miles, to 60 central towns or stations, where one or more manipulators were occupied in deciphering the transmitted symbols. Immediately on its arrival at Liverpool, Birmingham, Rotherham, Wolverhampton, Leeds, Wakefield, Halifax, Hull, Rochdale, Gosport, Southampton, Dorchester, Gloucester, Leicester, Manchester, Derby, Nottingham, Lincoln, Sheffield, York, Newcastle, Norwich, Edinburgh, and Glasgow, the speech was printed and generally distributed ; and the local papers published special editions.—*Daily News.* [We take this opportunity of directing the reader's attention to a clever sketch of the employment of Electrical Agency for Telegraphic Purposes, from the close of 1842 to the commencement of 1848 ; in the *Companion to the Almanac* for the latter year, p. 67 to p. 81.]

PROGRESS OF THE ELECTRIC TELEGRAPH.

At the late Meeting of the British Association, the learned chairman, Sir R. H. Inglis, thus adverted to the progress of the Electric Telegraph, from a Report presented to the Legislative Council and Assembly of New Brunswick, relative to a project for constructing a railway, and with it a line of electro-magnetic telegraph, from Halifax to Quebec :—

" The system," said Sir R. H. Inglis, " is daily extending. It was, however, in the United States of America that it was first adopted on a great scale, by Prof. Morse in 1844 ; and it is there that it is now already developed most extensively. Lines for above 1,300 miles are in action, and connect those States with Her Majesty's Canadian provinces; and it is in a course of development so rapid, that, in the words of the Report of Mr. Wilkinson to my distinguished friend, his Excellency Sir W. E. Colebrooke, the Governor of New Brunswick, to which I have just adverted. No schedule of telegraphic lines can now be relied upon for a

month in succession, as hundreds of miles may be added in that space of time. So easy of attainment does such a result appear to be, and so lively is the interest felt in its accomplishment, that it is scarcely doubtful that the whole of the populous parts of the United States will, within two or three years, be covered with a network like a spider's web, suspending its principal threads upon important points, along the sea-board of the Atlantic on one side, and upon similar points along the Lake Frontier on the other." I am indebted to the same Report for another fact, which I think the Association will regard with equal interest: "The confidence in the efficiency of telegraphic communication has now become so established, that the most important commercial transactions daily transpire, by its means, between correspondents several hundred miles apart. Ocular evidence of this was afforded me by a communication a few minutes old between a merchant in Toronto and his correspondent in New York, distant about 632 miles." I am anxious to call your attention to the advantages which other classes also may experience from this mode of communication, as I find it in the same Report. When the *Hibernia* steamer arrived in Boston, in January 1847, with the news of the scarcity in Great Britain, Ireland, and other parts of Europe, and with heavy orders for agricultural produce, the farmers, in the interior of the States of New York,—informed of the state of things by the Magnetic Telegraph—were thronging the streets of Albany with innumerable team-loads of grain almost as quickly after the arrival of the steamer at Boston as the news of that arrival could ordinarily have reached them. I may add, that, irrespectively of all its advantages to the general community, the system appears to give already a fair return of interest to the individuals or companies who have invested their capital in its application."

Prof. Morse states, as the result of improvements in this Telegraph, the President's message, entire, on the subject of the war with Mexico, was transmitted with perfect accuracy at the rate of 99 letters per minute. His skilful operators in Washington and Baltimore printed these characters at the rate of 98, 101, 111, and one of them actually printed 117 letters per minute. He must be an expert penman who can write legibly more than 100 letters per minute; consequently, this mode of communication equals, or nearly equals, *the most expeditious mode of recording thought.*

SUBMARINE TELEGRAPH ACROSS PORTSMOUTH HARBOUR.

Although the Electric Telegraph from the Nine Elms terminus of the South Western Railway to the terminus at Gosport, has been established three years, no attempt has been made to complete the communication to the Dockyard, because it was considered almost impossible to convey it under water. An offer was made to the Admiralty to lay down a telegraph inclosed in metallic pipes, which were to be fixed under the water by the aid of diving bells; but this was found to be impracticable. Whatever difficulties may have hitherto interfered to prevent the establishment of submarine telegraphs, appears now to have been entirely overcome, for the time occupied from the commencement of carrying the telegraph across Portsmouth Harbour, and transmitting signals, does not occupy a quarter of an hour. The telegraph, which has the appearance of an ordinary

rope, is coiled into one of the dockyard boats, one end of it being made fast on shore; and as the boat is pulled across, the telegraphic rope is gradually paid out over the stern, its superior gravity causing it to sink to the bottom immediately. The telegraph consists of but this line, and, unlike those along the various railways, requires no return wires to perfect the circuit. The electric fluid is transmitted from the batteries in the dock-yard, through the submersed insulated wire to the opposite shore; the fluid returning to the negative pole through the water without the aid of any metallic conductor, except a short piece of wire thrown over the dock-yard parapet into the water, and connecting it with the batteries. The fact of the water acting as a ready return conductor is established beyond question. It will be recollected that in 1842, Mr. Snow Harris, when proving the efficiency of his lightning conductors in his experiments from this dock-yard to the Orestes, exemplified that water would serve to complete the electric circuit. On that occasion, the distance traversed by the return current through the water was but trifling compared with the space accomplished in the present instance. The batteries used are Smee's; and a very delicate and accurate galvanic detector, invented by Mr. Hay, the chemical lecturer of the dock-yard, has also been brought into requisition. Independent of the simplicity of this submarine telegraph, it has an advantage which even the telegraphs on land do not possess,—in the event of accident, it can be replaced in ten minutes.—*Hampshire Guardian.*

SIGNALS FOR RAILWAY GUARDS.

EXPERIMENTS have been made for testing an invention by Messrs. Brett and Little, intended to give the means of communication between Railway Guards and Drivers. On the engine, and close to the driver, is placed an alarum bell of simple construction—not liable to get out of order, or to be affected by the oscillation of a train, and requiring to be wound up as a clock only about once a week for ordinary use. When not required for signals, the alarum is prevented from acting by a catch. Contiguous to this is a permanent magnet connected with the inventors' patent galvanic battery, which is placed at the opposite end of the tender. Wires are passed from the alarum to the battery, and thence continued throughout the train in this manner:—From chain to chain of each carriage is placed a galvanized wire, running beneath the carriages, so that the simple operation of hooking the usual safety chain forms a galvanic communication with as many carriages as are furnished with the connecting wires. At every guard-box a pair of branch wires is carried up at the end of the carriage into the box; where, by the simple operation of moving a small winch, the galvanic circuit is completed—the magnet immediately acts on the catch so as to lift it, and the alarum is set in motion close to the driver. Pairs of branch wires can likewise be carried into every carriage of the train if thought desirable. In every instance the signal was made without a single failure. To avoid the possibility of a failure from the oxidation of chains long out of use, it is proposed by the inventors that the chains should be galvanized by a simple inexpensive process.—*Athenæum*, No. 1053.

Chemical Science.

THE BAKERIAN LECTURE.

Mr. W. R. Grove, M.A., F.R.S., has delivered before the Royal Society, the Bakerian Lecture — "On certain Phenomena of Voltaic Ignition, and on the Decomposition of Water into its constituent gases by heat."

We have already detailed the substantial points of this discovery, in the *Year-book of Facts*, 1847, p. 171, so that we shall only quote the supplementary remarks appended to the lecture. In these, the author considers how far catalysis affects the phenomenon, and regards the decomposition thus produced as presenting a parallel effect produced by the force of heat, to that known to be produced by electricity; he considers it explanatory of the decomposition of water by the electrical spark, as in the experiments of Pearson and Wollaston. Some further experiments are given, in which iridium and osmium and silica are substituted for platinum; and also some experiments on the liquids bromine and chloride of iodine, both of which yield pure oxygen when exposed to the ignited wire in Mr. Grove's apparatus. These last experiments cannot however be long continued, in consequence of these liquids ultimately attacking both the glass and the platinum. In conclusion, the author calls attention to the general evolution of permanent gas from all liquids, except the metals, when exposed to intense heat.

TRANSFORMATIONS PRODUCED BY CATALYTIC BODIES.

Dr. Lyon Playfair has communicated to the Chemical Society, an elaborate inquiry on this subject.

"Berzelius," it is observed, "rendered a most useful work to science, when he collected into one class those varied phenomena of chemical action resulting from causes certainly very different from the ordinary manifestations of those affinities which produce combinations or promote decompositions. This philosopher believes the power which causes decomposition without the power of the acting body participating in its result, to be a distinct electro-chemical agency different from other recognized powers, and he named it "the Catalytic force." According to this view, catalytic bodies do not act by chemical affinity, but they excite inherent affinities in other substances, in consequence of which new combinations or decompositions ensue.

After explaining many instances of catalytic decompositions, Dr. Playfair observes:—In conclusion, facts have been brought forward to show that there is at least as much probability in the view that the catalytic force is merely a modified form of chemical affinity exerted under peculiar conditions, as there is in ascribing it to an unknown power, or to the communication of an intestine motion to the atoms of a complex molecule. Numerous cases have been cited in which the action results when the assisting or catalytic body is not in a state of change, and attempts have been made to prove by new experiments that the catalytic body exercises its peculiar power *by acting in the same direction* as the

body decomposing or entering into union, but under conditions in which its own affinity cannot always be gratified. The catalytic body is, therefore, a substance which acts by adding its own affinity to that of another body, or by exerting an attraction sufficient to effect decomposition under certain circumstances, without being powerful enough to overcome new conditions, such as elasticity and cohesion, which occasionally intervene and alter the expected result.

HYDRO-OXYGEN BLOWPIPE FOR THE FUSION OF PLATINUM.

Dr. Hare has communicated to the *Philosophical Magazine*, No. 209, certain improvements in the construction and supply of the Hydro-Oxygen Blowpipe, by which Platinum may be fused in the large way.

Although small lumps of platinum had been fused by many operators with the hydro-oxygen blowpipe as well as Dr. Hare, it had not, up to the year 1837, been found sufficiently competent to enable artists to resort to this process. There was an impression that the metal was rendered less malleable when fused upon charcoal, as in the experiments alluded to. This is contradicted by Dr. Hare's experiments, agreeably to which fused platinum is as malleable as the best specimens obtained by the Wollaston process, and is less liable to flake. Dr. Ure, on seeing specimens of platinum which Dr. Hare had elaborated and fused in the form of wire, of leaf, ingots and plate, said that there was no one in Europe who could fuse platinum in such masses. He also stated, that it had been found so difficult to weld platinum, that no resort was had to that process. In this Dr. Hare concurs, having had the welding tried by a skilful smith, both with a forge heat, and with a heat given by the hydro-oxygen blowpipe. An incorporation of two ingots was effected on their being hammered together, when heated nearly to fusion; but on hammering the resulting mass cold, a separation took place along the joint by which the ingots were united.

The difficulty seems to arise from the rapidity with which the platinum becomes refrigerated. It appears to have a less capacity for heat than iron; and, not burning in the air as iron does, has not the benefit of the heat acquired by iron from its own combustion with atmospheric oxygen.

Lately, by means of the instrument and process which are described in this paper, Dr. Hare has been enabled to obtain malleable platinum directly from the ore, by the continued application of the flame. From some specimens of platinum Dr. Hare has procured as much as ninety per cent. of malleable metal. The malleability is not inferior to that of the best specimens obtained by reducing it to the state of sponge, through the agency of aqua regia and sal-ammoniac. There is, however, a greater liability to tarnish, arising probably from the presence of a minute portion of palladium.—See the paper, with several illustrations, in the *Philosophical Magazine*, No. 209.

WIDE DIFFUSION OF SILVER.

MM. Malaguti and Durocher, from the numerous researches which they have made on a large series of specimens from different parts of Europe, have inferred the general fact, that all metallic com-

pounds which accompany or are found near argentiferous minerals contain more or less Silver; so that they deem it an established fact, that Silver is probably one of the most widely diffused metals in nature.—*Comptes Rendus.*

ARTIFICIAL PRODUCTION OF PRECIOUS STONES.

M. Ebelmen, as the first results of several experiments to produce Minerals, and especially Precious Stones, artificially, states that it is possible to realize at temperatures lower than those obtainable in our furnaces, diaphanous crystals, the hardness and external characters of which are analogous to those of precious stones; and he also concludes that many mineral species may be formed at a lower temperature than that required for their fusion.—*Comptes Rendus*, August 16, 1847.—(See the details in the *Philosophical Magazine*, No. 208.)

SULPHURIC ACID.

Mr. H. M. Noad has delivered to the College of Chemistry, a lecture "On the Manufacture, Properties, and Uses of Sulphuric Acid," in which he gave a detailed account of the present mode of preparing sulphuric acid on the large scale;—imitating it on the lecture table by causing two streams of sulphurous acid and nitric oxide gases to come into contact, together with steam and common air, into a large glass globe; and he explained the theoretical nature of the reactions which took place, by means of diagrams. The leaden chambers employed in some manufactories were stated to be of immense size—upwards of 180 feet long, having a capacity of 35,000 cubic feet, and being capable of preparing ten tons of acid weekly. The great saving effected by the modern improvement of substituting vessels of platinum for those of glass for the final concentration of the acid, notwithstanding the enormous price of the former, is manifested by the fall in the price of sulphuric acid from 4d. to 1½d. per pound. The lecturer performed a series of experiments in illustration of the valuable properties of sulphuric acid. He adverted to its great use as an elegant and economical means of refining silver—and to its introduction into agriculture as a solvent for bones, by which phosphate of lime is not only brought into a liquid state, and thus more intimately diffused through the soil—but a portion of phosphoric acid is likewise set free to combine with lime or other basic matters in the soil. The lecture was concluded by observations as to the manner in which the sulphates act as manures; viz., by furnishing the necessary supply of sulphur to those parts of plants in which this element is found—and of which it appears to be an essential constituent—viz. the gluten and albumen of the several varieties of grain, and the legumin of those which are called *leguminous*. —*Athæneum*, No. 1030.

NEW TEST FOR PRUSSIC ACID, AND ON A SIMPLE METHOD OF PREPARING THE SULPHOCYANIDE OF AMMONIUM. BY PROF. LIEBIG.

When some sulphuret of ammonium and caustic ammonia are added to a concentrated aqueous solution of Prussic Acid, and the mixture heated with the addition of pure flowers of sulphur, the Prussic Acid is

converted in a few minutes into Sulphocyanide of Ammonium. This metamorphosis depends on the circumstance, that the higher sulphurets of ammonium are instantly deprived by the cyanide of ammonium of the excess of sulphur they contain above the monosulphuret: for instance, if a mixture of prussic acid and ammonia be added to the pentasulphuret of ammonium, the solution of which is of a deep yellow colour, and the whole gently heated, the sulphuret of ammonium is soon decolorized; and when the clear colourless liquid is evaporated, and the admixture of sulphuret of ammonium expelled, a white saline mass is obtained, which dissolves entirely in alcohol. The solution yields, on cooling or evaporation, colourless crystals of pure cyphocyanide of ammonium. Only a small quantity of sulphuret of ammonium is requisite to convert, in the presence of an excess of sulphur, unlimited quantities of cyanide of ammonium into sulphocyanide; because the sulphuret of ammonium, when reduced to the state of monosulphuret, constantly reacquires its power of dissolving sulphur and transferring it to the cyanide of ammonium.

The following proportions will be found to be most advantageous:—2 oz. of solution of caustic ammonia of 0·95 sp. gr. are saturated with sulphuretted hydrogen gas; the hydrosulphate of ammonia thus obtained is mixed with 6 oz. of the same solution of ammonia, and to this mixture 2 oz. of flowers of sulphur are added; and then the product resulting from the distillation of 6 oz. prussiate of potash, 3 oz. of the hydrate of sulphuric acid, and 18 oz. water. This mixture is digested in the water-bath until the sulphur is seen to be no longer altered and the liquid has assumed a yellow colour; it is then heated to boiling, and kept at this temperature until the sulphuret of ammonium has been expelled and the liquid has again become colourless. The deposited, or excess of, sulphur is now removed by filtration, and the liquid evaporated to crystallization. In this way, from $3\frac{1}{3}$ to $3\frac{1}{2}$ oz. of dazzling white dry sulphocyanide of ammonium are obtained, which may be employed as a reagent, and for the same purposes as the sulphocyanide of potassium. Of the 2 oz. of sulphur added, $\frac{1}{2}$ an oz. is left undissolved.

The behaviour of the higher sulphurets of ammonium towards prussic acid furnishes an admirable test for this acid. A couple of drops of a prussic acid, which has been diluted with so much water that it no longer gives any certain reaction with salts of iron by the formation of prussian blue, when mixed with a drop of sulphuret of ammonium, and heated upon a watch-glass until the mixture is become colourless, yields a liquid containing sulphocyanide of ammonium, which produces with persalts of iron a very deep blood-red colour, and with persalts of copper, in the presence of sulphurous acid, a perceptible white precipitate of the sulphocyanide of copper.—Liebig's *Annalen*, Jan. 1847; *Philosophical Magazine*, No. 206.

CARBONIC ACID, A SOLVENT IN VEGETATION.

A PAPER has been read to the Royal Society, "On Carbonic Acid as a Solvent in the Process of Vegetation," by Dr. J. Davy. The author described the results of experiments made with water saturated with Carbonic Acid, in many instances condensed by pressure and supersatu-

rated, on the more important inorganic elements of plants, compounds not soluble in water alone, such as phosphate of lime, silica, &c. These results appear to prove that this acid performs in the economy of growing plants a double function; one well known, and already carefully studied, by which, undergoing decomposition in the leaves under the influence of solar light, it supplies carbon to the growing vegetable, and restores oxygen to the atmosphere; the other, hitherto little attended to, in which it acts as a menstruum, conveying certain compounds, insoluble in water, from the soil into the interior of plants, to become constituents of their organism. The experiments detailed were of two kinds; one set being on single compounds, the other on a mixture of the compounds. The results of the latter seem to prove that water impregnated with carbonic acid is capable of dissolving several substances at the same time, and of keeping them mixed in solution; as carbonate of lime, carbonate of magnesia, phosphate of lime, silica, &c.

ACTION OF CHLORINE ON ALCOHOL.—FORMATION OF ACETAL.

M. Stas states, that he has observed that the causes which give rise to Acetal are not always oxidating causes. When Chlorine is made to act upon Alcohol, acetal is the principal product, as long as it does not act by substitution, and it is at once a dehydrogenating and an oxidizing body. This discovery, the author is of opinion, throws great light on the hitherto obscure action of chlorine upon alcohol.

In order to obtain acetal by the action of chlorine upon alcohol, it is sufficient to pass a current of chlorine into alcohol of 80 per cent., cooled to 50° or 60° F. The action is to be discontinued when chlorinated bodies commence formation by substitution: this is readily ascertained, for the alcohol then becomes turbid on the addition of water: the liquid, which has become very acid, is to be distilled, and one-fourth of the quantity is to be preserved. This is to be neutralized by means of chalk, and by a fresh distillation one-fourth of the product is again to be obtained; in this, fused chloride of calcium is to be dissolved, which immediately separates a large quantity of a very volatile fluid, containing, like common rough acetal, aldehyd, acetic ether and alcohol; by the addition of more chloride of calcium, the utmost quantity of alcohol and acetic ether are separated; the purification of the acetal is then to be completed.

The analysis of the acetal thus obtained was similar to that procured in the usual way; and thus the chlorine acts, as already stated, both as a dehydrogenating and oxidizing body: $C^{12}H^{18}O^6 + 2Ch - 2HO = C^{12}H^{14}O^4 + 2CH + 2HO$.—*Ann. de Chim. et de Phys.* Feb. 1847; *Philosophical Magazine,* No. 205.

ARSENIC IN MINERAL WATERS.

Arsenic has been found by M. Valchner in various Mineral Waters at Viesbade in Germany, and this has been confirmed by M. Figuer. The last-mentioned chemist has ascertained that Arsenic is in the state of arsenious acid, and that the proportion is nearly 0·045 grammes in 100

litres of the water. He detected no arsenic in the waters of Passy.—*L'Institut*, No. 670.

NITRIFICATION.

M. Dumas states, that when a current of moist air, containing ammonia, is directed upon a solution of potash, the temperature being at 100° C., a quantity of nitrate of potash is formed through a change of the ammonia into nitric acid. He remarks, that this experiment, which accords with the labours of M. Kuhlman on Nitrification, was suggested to him by observations which he had recently made upon the conversion of sulphuretted hydrogen into sulphuric acid.—*L'Institut*, No. 674.

EXHALATION OF BICARBONATE OF AMMONIA BY THE LUNGS.

Mr. Lewis Thompson, M.R.C.S., of Newcastle-on-Tyne, having occasion to ascertain the amount of moisture given off by the lungs of several healthy individuals during a fixed period, was induced to examine the nature of the fluid thus condensed. The result has proved that bicarbonate of ammonia is constantly exhaled from the lungs to the extent of rather more than three grains every twenty-four hours for each individual; and although this quantity may appear trifling, yet the amount arising from a large population like that of London is well worthy of notice, and must exceed 150 tons of solid bicarbonate of ammonia per annum: and if, as is extremely probable, other animals also exhale this substance, the atmosphere must not only always contain enough of this agent for the purposes of vegetation, but, by a reciprocal action, the mutual increase of vegetables and animals would only tend to render the air better adapted for the due development of both. The existence of ammonia in the breath may easily be demonstrated, by respiring air which has passed through diluted sulphuric acid, and then expiring it through a tube surrounded by water at 32° F., to the further end of which a vessel is attached to receive the fluid which condenses. On acidulating this fluid with one or two drops of pure muriatic acid, and evaporating to dryness on a water-bath, a residue will be obtained, which, when dissolved in five or six drops of water, and introduced into a small test-tube, will give off ammonia on the addition of two or three drops of a strong solution of potash, as evidenced by its action on turmeric paper and muriatic acid, or by its peculiar smell. The respiratory process should be continued for an hour or two.

It would be interesting to know whether any difference is observable in the amount of ammonia exhaled from the lungs of individuals suffering from disease of the kidney, diabetes, &c.—*Communicated to the Philosophical Magazine*, No. 199.

ETHERIZATION OF VEGETABLES.

M. Clemens, Professor of Natural Sciences at the College of Vevay, has lately addressed a memorial to the Academy of Sciences of the Vaud, giving the results of experiments made by him in order to ascertain the effects of Ether upon Vegetables; from which he finds plants may be etherized as easily as man and other animals. He says: "Take a branch

of the *berberis vulgaris*, the common barberry, and put it under a drinking glass, with a small quantity of ether, for a minute at most if in the sun, and during three minutes at most if in the shade, but at a temperature of not less than 12° of Reamur (59° Fahrenheit); and when it is withdrawn, it will be found, on touching the stamina at their base, that they have lost all their irritability, which will not return in the first instance until after a considerable time, the influence of the ether having been much stronger. In the second case, on the contrary, the primitive irritability is recovered in half an hour. The plant may be etherized a second time; and this second etherization must not be any longer than the first; and after half an hour the plant resumes all its vigour. To etherize a sensitive plant, *mimosa pudica*, the process must be continued for eight or ten minutes, and a proportionably longer time in the shade. The acetic, chlorhydric, and nitric ethers, act in the same manner; but the sulphuric and acetic ethers are the most effective.—*Mechanics' Magazine*, No. 1247.

NEW ANÆSTHETIC AGENT—CHOLOROFORM.

Dr. Simpson, of Edinburgh, has discovered an Anæsthestic Agent, as a substitute for sulphuric ether* in surgery and midwifery, viz. Chloroform, or the Perchloride of Formyle.

Chloroform was first discovered and described at nearly the same time by Soubeiran, (1831, and Liebig, 1832); its composition was first accurately ascertained by the distinguished French chemist Dumas, in 1835. (See *Annales de Chimie et de Physique*, vols. xlviii., xlix.,and lviii.) It had previously been used by some practitioners internally; Guillot prescribed it as an antispasmodic in asthma, exhibiting it in small doses, and diluted 100 times. (See Bouchardat's *Annuaire de Thérapeutique*, for 1844, p. 35.) But no person, as far as Dr. Simpson is aware, had used it by inhalation, or discovered its remarkable anæsthetic properties, till the date of his own experiments.

It is a dense limpid, colourless liquid, readily evaporating, and possessing an agreeable, fragrant, fruit-like odour, and a saccharine pleasant taste.

As an inhaled anæsthetic agent, it possesses over sulphuric ether the following advantages:—1. A greatly less quantity of chloroform than of ether is requisite to produce the anæsthetic effect. 2. Its action is much more rapid and complete, and generally more persistent. 3. The inhalation and influence of chloroform are far more agreeable and pleasant than those of ether. 4. The use of chloroform is less expensive than that of ether. 5. Its perfume is not unpleasant; nor does it exhale in a disagreeable form from the lungs of the patient, as so generally happens with sulphuric ether. 6. Being required in much less quantity, it is much more portable and transmissible than sulphuric ether. 7. No special kind of inhaler or instrument is necessary for its exhibition. A little of the liquid diffused upon the interior of a hollow-

* Described as a "New Means for rendering Surgical Operations painless," in the *Year-book of Facts*, 1847, p. 188. This new application of Chloroform dates from Nov. 10, 1847; see the *Pharmaceutical Times*, No. 65, pp. 131—137.

shaped sponge, or on a pocket-handkerchief, or a piece of linen or paper, or held over the mouth and nostrils, so as to be fully inhaled, generally suffices in about a minute or two to produce the desired effect.

The following is the chemical constitution of Chloroform :—Formyle is the hypothetical radical of Formic acid, first discovered in the red ant (*Formica rufa*), and hence named. It is now obtained from starch, sugar, and, indeed, from most other vegetable substances.

A series of Chlorides of Formyle are produced when chlorine and the hypochlorites are brought to act on the chloride, oxide, and hydrated oxide of methyle (pyroxylic or wood spirit). In the same way as formic acid may be artificially procured from substances which do not contain Formyle ready formed, so also are the Chlorides of this radical capable of being procured from substances which do not originally contain it.

Chloroform, Chloroformyle, or the Perchloride of Formyle, may be made and obtained artificially by various processes,—as by making milk of lime, or an aqueous solution of caustic alkali act upon chloral,—by distilling alcohol, pyroxylic spirit, or acetone, with chloride of lime,—by leading a stream of Chlorine gas into a solution of caustic potass in spirit of wine, &c. The resulting Perchloride of Formyle consists of two atoms of Carbon, one of Hydrogen, and three of Chlorine.

It is now well ascertained that three compound chemical bodies possess, when inhaled into the lungs, the power of superinducing a state of anæsthesia, or insensibility to pain in surgical operations, &c., namely, Nitrous Oxide, Sulphuric Ether, and Perchloride of Formyle. These agents are entirely different from each other in their chemical constitution; hence their elementary composition affords no apparent clue to the explanation of their anæsthetic properties.*

FIELD'S EBULLITION ALCOHOMETER.

THAT the boiling temperature of water is increased by holding neutro-saline and saccharine substances in solution, has been long known, and has been the subject of many experiments, made partly with the view of ascertaining from that temperature the proportion of the salt or sugar, and partly with the view of obtaining a practical liquid bath. But it seems to have been reserved for the Abbé Brossard-Vidal, of Toulon, to have discovered that the boiling temperature of alcoholic liquors is, in most cases, proportional to the quantity of alcohol, irrespectively of the quantity of neutra-saline or saccharine matter dissolved in them. When, however, such a quantity of dry carbonate of potash, or sugar, is added to a spirituous liquor as to abstract or fix in the solid state a portion of the water present, then the boiling temperature of that mixture will be lowered in proportion to the concentration of the alcohol, instead of being raised, as would be the case with water so mixed. But, generally speaking, it may be assumed as a fact, that the boiling point of an alcoholic liquor is not altered by a moderate addition of saline, saccharine, or extractive matter. On this principle, M. Brossard-Vidal has constructed an

* See Dr. Simpson's Account of the New Agent, published by Sutherland and Knox, Edinburgh; and Highley, Fleet-street, London.

instrument for determining by that temperature the proportion of alcohol present; and this instrument he has named an Alcohometer.

Dr. Ure has, however, renounced the construction of M. Vidal, and adopted a more simple and direct form, which has been patented by Mr. Field. It consists, first, of a spirit-lamp, surrounded by a saucer for containing cold water to keep the lamp cool, should many experiments require to be made in succession; and, second, of the boiler, which fits by its bottom cage on the case of the lamp. There is a damper-plate for modifying the flame of the lamp, or extinguishing it when the experiment is completed. Upon the border is fixed a thermometer made with a very minute bore, in the manner of the Rev. Mr. Wollaston's instrument for measuring the height of a mountain by the boiling point of water on its summit. The bottom of the scale in the ebullition thermometer is marked P, for proof, on the left side, and 100 (proof spirit) on the right side. It corresponds to 178·6 Fahr. nearly, or the boiling point of alcohol of 0·920 specific gravity.

The alcohometer will by itself only indicate the per centage of alcohol contained in any wine; but by the aid of the hydrometer, the proportionate quantity of saccharum in all wines may be readily and easily determined. The hydrometer will show the specific gravity of the liquid upon reference to a table provided for the purpose.

We have thus briefly described the principle of this new instrument: its details are given by Dr. Ure, in the *Pharmaceutical Journal* for October, 1847; and are quoted in the *Mechanics' Magazine*, No. 1266. To Brewers, Distillers, &c., the Ebullition Alcohometer must prove an important improvement in ascertaining the relative value of their liquors.

NEW TEST FOR OZONE.

THE following letter has been received from Professor Schœnbein, by Professor Faraday, and by the latter communicated to the *Philosophical Magazine*, No. 207:—

"Having a good opportunity for sending you a few lines, I will make use of it to tell you something about my little doings. You are no doubt struck with the peculiarity of the ink in which this letter is written, and I am afraid you will think it a very bad production; but in spite of its queer colour you will like it when I tell you what it is, and when I assure you that as long as the art of writing has been practised no letter has ever been written with such an ink. Dealing now again in my ozone business, I found out the other day that all manganese salts, be they dissolved or solid, are decomposed by ozone, hydrate of peroxide of manganese being produced and the acid set at liberty. Now to come round again to my ink, I must tell you that these lines are written with a solution of sulphate of manganese. The writing being dry, the paper is suspended within a large bottle, the air of which is strongly ozonized by means of phosphorus. After a few minutes the writing becomes visible, and the longer you leave it exposed to the action of oxone the darker it will become. Sulphurous acid gas uniting readily with the peroxide of manganese to form a colourless sulphate, the writing will instantly disappear when placed within air containing some of that acid; and it is a matter of course that the writing will come out again when again exposed to ozonized air. Now all this is certainly mere playing; but the matter is interesting in a scientific point of view, inasmuch as dry strips of white filtering paper drenched with a weak solution of sulphate of manganese, furnish us with rather a delicate and specific test for ozone, by means of which we may easily prove the identity of chemical, voltaic, and electrical

ozone, and establish with facility and certainty the continual presence of ozone in the open air. I have turned brown my test-paper within the electrical brush, the ozonized oxygen obtained from electrolysed water and the atmospheric air ozonized by phosphorus. The quantity of ozone produced by the electrical brush being so very small, it requires of course some time to turn the test-paper brown.

"As it is rather inconvenient to write with an invisible ink, I will stop here; not, however, before having asked your kind indulgence for the many blunders and faults which my azone-bottle will no doubt bring to light before long.

"Yours most truly,

"Bâle, July 1, 1847." "C. F. Schœnbein."

OXIDIZING POWERS OF OZONE ON SALTS OF MANGANESE AND LEAD.

Prof. Schœnbein has detailed to the British Association, some experiments which go to prove the Oxidizing Powers of Ozone on Salts of Manganese and Lead. Upon adding ozonized air to solutions of the sulphate or chloride of manganese, and agitating the vessel, ozone disappears, and a hydrate of the peroxide of manganese is precipitated. This effect is not, however, produced by the action of either chlorine or of bromine in the dark; but by exposure to the light these elements act in a similar manner to ozone. Incidentally to these experiments, it was stated that strong nitric acid is rapidly decomposed by muriatic acid, even at a temperature below zero, into hyponitric acid, chlorine, and water; whilst chlorine and hyponitrous acid are transformed into nitric acid and muriatic acid.—*Athenæum*, No. 1028.

TITANIUM.

An experimental investigation of Titanium and its salts, by M. A. Demoly, gives the following results:—The atomic weight of titanium is 350; the oxide of titanium always plays the part of an acid; titanic acid presents itself in two distinct forms, perfectly defined; its formula is $Ti\,O^2$; its equivalent 550. The formula of anhydrous metatitanic acid is $Ti\,O^6$; equivalent 1650. The formula of the hydrated chloride of titanium is $Ti\,Cl^2 + 2\,H\,O$; it has acid properties, forming double chlorides, whose general formula is $Ti\,Cl^2\,M\,O + 5\,H\,O$; and it combines with alcohol and with sulphuric ether, the formula of these combinations being $Ti\,Cl^2\,2\,M$.—*Literary Gazette*, No. 591.

DIAMONDS CONVERTED INTO COKE.

Dr. Faraday has exhibited to the British Association, some Diamonds, received by him from M. Dumas, which had, by the action of intense heat, been converted into Coke. In one case, the heat of the flame of oxide of carbon and oxygen had been used—in another, the oxyhydrogen flame—and in the third the galvanic arc of flame from a Bunsen battery of 100 pairs. In the last case, the diamond was perfectly converted into a piece of coke; and in the others the fusion and carbonaceous formation were evident. Specimens, in which the character of graphite was taken by the diamond, were also shown. The electrical characters of these diamonds were stated also to have been changed,—the diamond being an insulator, while coke is a conductor.

ANALYSIS OF THE BOHEMIAN GLASS. BY MR. ROWNEY.

This is the Glass so valuable for its infusibility in the construction of the combustion tubes used in organic analysis. Although soda was found present to the extent of one-fourth of the potash, the glass appears to be essentially a silicate of lime and potash,—in which the oxygen in the silicic acid is to that in the basis as 6 to 1. It gave 73 per cent. of silicic acid, 11½ potash, 3 soda, 10½ lime, with small portions of alumina, peroxide of iron, magnesia, and oxide of manganese, to make up 100 parts.

SUGAR IN HEALTHY BLOOD.

In the *Philosophical Magazine* for May, 1845, p. 422, are detailed some experiments by Dr. R. D. Thomson, which show that when starch has been digested in considerable quantities by animals, it passes into the condition of soluble starch, or dextrine and sugar, and being absorbed in the latter form into the blood, can be detected in that fluid during the period of digestion. The experiments detailed in the paper referred to were made in 1844. Magendie has lately, in a paper communicated to the French Academy (*Comptes Rendus*, xxiii. p. 189), obtained similar results. He found that when a dog was fed on cooked potatoes, the blood contained dextrine and grape-sugar. He observed also, that if starch be mixed with fresh serum, it is so transformed in a few seconds that it cannot be detected by reagents, and in a quarter of an hour sugar makes its appearance. This exactly corresponds with the previous results obtained by Dr. Thomson in 1844, who "was unable to detect any traces of starch in the serum of the blood" (*Philosophical Magazine*, May 1845, p. 420), but easily obtained evidence of the presence of sugar in the same blood. —*Philosophical Magazine*, No. 202.

WATER POISONED BY COPPER IN BRASS FORCE-PUMPS: TESTS FOR COPPER AND LEAD.

Mr. Henry Osborne, of Southampton, has discovered Copper in the state of oxide in Water, and offers the following mode of detecting its presence:—To an ale-glass of the suspected water, taken directly from the pump, add a few drops of solution of ferrocyanuret of potassum: a faint reddish-brown tint will soon be perceived if copper be present, and in the course of twenty-four to forty-eight hours a precipitate of the same colour will deposit at the bottom of the vessel. Sulphuretted hydrogen strikes a brownish-black colour to water containing copper, but a similar colour is produced with oxide of lead, and black with peroxide of iron. To discriminate between lead and copper, or iron, add to another portion of the suspected water a dropor two of solutionof bichromate of potash; a blueish-yellow turbidity and precipitate, soluble in potash, indicates lead. In a communication to the *Hampshire Advertiser*, Mr. Osborne says, "I found water capable of taking up cop per in the short space of a quarter of an hour, or twenty minutes; but the quantity is small, and may be readily removed by filtration."

NEW TEST FOR WATER.

M. Dupasquier has communicated to the Academy of Sciences, at Paris, a New Mode of Testing Water, in order to ascertain the quantity of organic matter held in solution. He puts into a glass globe from one to two ounces of water, to which he adds a few drops of a solution of chloruret of gold, sufficient to give it a slight yellow tinge. He then boils the water. If it contains only the ordinary quantity of organic matter of potable water, the yellow tinge remains as it was even if the ebullition be prolonged. If, on the contrary, the quantity of organic mater be in excess, the water becomes first brown, and then assumes a violet tint, which announces the decomposition of a salt of gold by the organic matter. By prolonging the ebullition, the violet tint becomes deeper and deeper if the quantity of organic matter be considerable. But the mere brown tint alone serves to show that the quantity of organic matter exceeds the ordinary proportion.

COFFEE AS AN ANTIDOTE TO ACETATE OF MORPHIA.

An invalid took at one dose ten grains and nearly eight-tenths of Acetate of Morphia; thirty grains of emetic tartar were exhibited without occasioning vomiting: after a lapse of three hours, and not till then, and when the patient was perfectly comatose, a strong infusion of coffee with the grounds was given. In the course of twelve hours, the invalid took about 11½ ounces of coffee; the coma ceased, and he recovered.

This fact proves, among a hundred others, that even in the worst cases of poisoning, the medical man should never despair of the recovery of his patient. In the above-described case, in spite of a very strong dose of poison, and notwithstanding the absence of all assistance during three entire hours, and although it was impossible to evacuate any portion of the morphia, the patient recovered. If a similar accident should again occur, vomiting ought to be immediately attempted; if this fail, the stomach-pump should be employed, and then concentrated coffee should be administered.—*Journ. de Pharm. et de Ch.*, Fevrier, 1847; *Philosophical Magazine*, No. 201.

CHEMICAL ACTION ARRESTED BY MECHANICAL VIBRATION.

A slip of iron, one quarter of an inch in diameter, was suspended perpendicularly by one end with a strong packthread, and, while so, a vessel of nitric acid was brought underneath it, and then raised so as to allow the lower end of the iron to dip into it. On this being done, energetic action took place, *which was immediately suspended on giving the top end of the slip a smart blow in a perpendicular direction* with a hammer. The iron was then let down in the acid, and remained perfectly inactive during two days. It also communicated inactivity to other pieces that were brought into contact with it. This experiment was subsequently varied, with, if possible, more interesting results. A wire, like the one formerly used, was suspended in the same manner, but the packthread was now held in the hand; it was then struck at the lower end obliquely with a piece of iron, to cause it to ring, and while so, it was introduced into the acid. No action took place on immersion, but the instant the end

of the iron came in contact with the side of the vessel, which had the effect of breaking the vibration, action proceeded most energetically, which, on being instantly removed to the centre, partially ceased; then went on, although less partially; but it was quite evident that, as the effects of the vibration became weaker, the action of the acid on the iron increased. Should it be immersed while under the effects of a slight ringing blow, the action is beautifully illustrative of molecular vibration, bubbles of gas being given off the surface of the iron in intermittent waves. Sometimes this is produced in a slip that has been often used, by a smart perpendicular blow at the bottom of the vessel containing the acid. A structural alteration throughout the molecules of iron has been long supposed to take place by some, and ridiculed as fanciful by others. This want of unity of opinion has sufficiently prevailed to prevent the fact from entering into practical consideration with regard to engineering matters.—*Mr. Spencer, in the Liverpool Mercury.*

NEW PRINCIPLE OF CRYSTALLIZATION.

If ordinary Crystallization be observed under a microscope, it will be found that a deposition of matter gradually takes place on all sides of the crystal. In addition to this accretion of particles under the force of crystallization, Mr. Fox Talbot considers that in some cases tension may be an incipient cause of crystallization. Several experiments of Sir D. Brewster, published some years since, showing that natural tension might be the cause of double refraction, were brought forward in support of this view. The following is the experiment upon which Mr. Fox Talbot rests his theory: a piece of nitrate of potash, no larger than a pin's head, is fused upon a piece of glass, and observed under the microscope with a polarizing apparatus; it then appears as one crystal, exhibiting the most beautiful and brilliant colours. This does not take place when glass or rock crystal are thus fused. It appeared, therefore, that this crystallization was not an accumulation of particles around a nucleus, but a species of crystallization depending entirely on internal tension. Sir D. Brewster is disposed to adopt this view of Mr. Talbot's.—*Proceedings of the British Association.*

NATURE OF HEAT.

Mr. Grove has detailed to the Royal Institution, an inquiry with the object,—1st, to illustrate and develope views already suggested by himself, in his treatise on "The Correlation of Physical Forces," p. 14, *et seq.;* and, 2ndly, to connect those views with his recent discovery of the decomposition of water by Heat. He then avowed his opinion to be in favour of the dynamic theory; or that which views heat, not as a simple emanation from matter, nor an undulation in an ethereal medium pervading matter—but, a force producing motion in matter itself, or in what we may term ordinary matter. Mr. Grove proceeded to prove that chemical affinity was, like cohesive force, antagonist to heat, and capable of being surmounted by it. In the analysis of cyanide of mercury by heat, he showed, that if composition be attraction, heat is the cause of repulsion—*i. e.* decomposition. In conclusion, he gave a brief review of those inves-

tigations into the decomposition of water with which we have already presented our readers. By these a striking exceptional case to his theory was removed, and every promise given of a generalized relation, or of the establishment of the law of continuity between physical and chemical attraction.

HEATED CURRENTS OF AIR IN MANUFACTURES.

Mr. J. Wishaw has shown the advantages arising from the application of currents of Heated Air to the following purposes, : seasoning timber generally—preserving timber—purifying feathers, blankets, clothing, &c. —drying coffee—roasting coffee—japanning leather for table covers, and other purposes—drying silks—drying yarn—drying distillers' tuns—drying papier-mâché—and drying vulcanized india-rubber. The process has also been successfully tested for drying loaf sugar—drying printing paper, or setting the ink, to enable books to be bound more quickly than usual—drying starch and converting it into dextine, or British gum—and preserving meat. It was stated that sixty suits of clothes which had belonged to persons who had died of the plague in Syria had been subjected to the process of purification at a temperature of about 240°, and afterwards worn by sixty persons; not one of whom ever gave the slightest symptom of being affected by the malady. The author referred to the mode adopted by the North American Indians for preserving the flesh of the buffalo,—that of drying it in the sun; and stated that heated currents had been applied successfully. How important for shipping, instead of sailors consuming salted provision from one month's end to another, to have an occasional supply of fresh meat! Meat treated in this way occupies much less space, too, and is much lighter in weight. It is believed that the juices of the meat contain about seven-eighths of watery moisture: this the current of heated air removes, leaving the albumen and all the flavour and nutrition behind.

NEW RESEARCHES IN ANIMAL CHEMISTRY. EXTRACTED FROM A LETTER FROM PROFESSOR LIEBIG TO DR. A. W. HOFMANN.

Prof. Liebig communicates as the result of his most recent investigations in Organic Chemistry, that he has succeeded in demonstrating, at least, the existence of both free lactic and phosphoric acids in the substance of the muscles of animals, although separated only by a thin membrane from the blood and other alkaline fluids in the vessels. To this difference in the condition of the solid muscles and fluids he attributes many of the galvanic effects observed by Matteucci. He has also confirmed the existence of the crystalline neutral substance *creatin*, first discovered in flesh by M. Chevreul; and observed two new crystalline bodies present in small quantity. While investigating the action of common salt in the animal economy, he finds that the fluids without the blood and lymphatic vessels contain only potash with phosphate of magnesia; while the blood and lymph contain only those of soda (phosphate of soda.) The brine of salted meat abstracts the soluble phosphates which are necessary to the formation of blood; and hence the scorbutic action of salted meat. The soup from boiled meat contains the soluble phosphates of the flesh, and the meat itself

the insoluble. Neither the soup nor the boiled meat can, therefore, alone maintain the process of life, but both must be taken together. It is also stated that, by the oxidation of casein, by the action of peroxide of manganese and sulphuric acid, M. Engelberger has obtained three curious products: namely, aldehyde, essential oil of bitter almonds, and a fluid ethereal body with a composition analogous to metacetone. Lastly, that protein prepared by the process of Müder, and supposed by that chemist to be free from sulphur, still contains the element in question, to the extent of 1·5 per cent.

CHEMICAL RESEARCHES ON THE YOLK OF EGGS.

M. Gobley states that the fresh researches* which he has made on this subject were undertaken with a two-fold object, one of which was to consider certain points which he had scarcely touched upon in his first communication; another object was to determine how far the objections of M. Sacc against his conclusions were well-founded: with these views the author modified several of his analytical processes, so as to be quite certain that he would avoid the causes of the errors which had been supposed to be discovered.

M. Gobley concludes from his recent experiments,—

1st. That the fatty matter of the yolk of egg is formed, as had previously been stated, of two distinct parts; one a fixed oil, the *oil of egg*, and of a soft, not fusible substance, *viscous matter*.

2nd. That the phosphorus does not occur in the oil, but in the viscous matter.

3rd. That olic, margaric, phosphoglyceric, lactic acids, and the extract of meat, are not products of oxidizement.

4th. That the viscous matter is not, as the author imagined, a combination of oleic, margaric and phophoglyceric acids with ammonia, but constitutes a body of a complex nature from which two different substances have been separated, to which the author has provisionally given the names of *phosphorized matter* and *cerebric matter*.

5th. That the phosphorized matter which forms in the future animal the substance described by M. Fremy as *oleophosphoric acid*, yields oleic, margaric and phosphoglyceric acids with the greatest facility, as products of decomposition in the presence of acids and mineral alkalies under the influence of water or alcohol, and without the intervention of the oxygen of the air.

6th. That the cerebric matter is analogous, if not identical, with the substance which Vauquelin, MM. Couerbe and Fremy, have successively described under the names of *fatty matter of the brain*, *cérébrote* and *cerebric* acid.—*Comptes Rendus; Philosophical Magazine*, No. 203.

PHOSPHATE OF LIME IN ORGANIC BONES.

M. Dumas attributes the disaggregation of bones on exposure in the soil, and the removal of the phosphate of lime by water, to two causes,

* For M. Gobley's previous Experiments, see Year-book of Facts, 1847, p. 200-1.

the one of feeble intensity, and acting rarely; the other of great force, and always in action. The first depends on the *ammoniacal* salt in waters, which salt enables them to dissolve phosphate of lime; this salt is everywhere present, but in so small a quantity as to have comparatively little influence. The second depends on carbonic acid, which appears to be the true solvent of phosphate of lime; for waters charged with carbonic acid dissolve large quantities of it. Alkalies and ebullition separate the carbonic acid, and precipitate the salt. The action of this acid is so powerful, that shavings of ivory placed in a bottle of Seltzer water, are softened in twenty-four hours, as if in chlorohydric acid; and the Seltzer water contains, afterwards, all the phosphate of lime contained in the ivory. This property, adds Dumas, enables us to understand the introduction of phosphate of lime into plants. These facts explain the disaggregation of bones, and the dissemination of the phosphate of lime in the soil through the carbonic acid contained in rain waters; they shew how, in the animal economy, bones may be redissolved by the venous blood charged with carbonic acid; they indicate the part which the fluoride of calcium acts in the teeth, in protecting the osseous portion from the carbonic acid disengaged from the lungs, and dissolved also in the saliva, which at the same time is alkaline, to neutralize the action of the acid. Dumas suggests the use of carbonated waters for persons affected with calculi of phosphate of lime. —*L'Institut*, No. 674; *Jameson's Journal*, No. 85.

ELLERMAN'S DISINFECTING AND DEODORISING PROCESS.

SOME experiments have been made at Hackney to test the efficacy of Mr. Charles F. Ellerman's Disinfecting process, which were perfectly successful, so far as could be ascertained by the sense of smell. Upon a collection of night-soil, yielding an almost unendurable fæcal smell, was poured a comparatively small quantity of the fluid; which had the immediate effect, on being thoroughly circulated, of banishing the foul smell, and imparting that which is peculiar to the re-agent itself, somewhat resembling the odour effused by a nitrous solution. The "disinfecting" properties of the re-agent could not of course be ascertained from the experiment. The deodorized matter was afterwards subjected to further treatment by Mr. Redwood, a professional chemist. He poured upon it a phialful of bisulphuret of carbon, and restored to it its original fæcal odour, in order again to test the chemical properties of the re-agent. The re-agent was again applied, and with the same satisfactory result—neutralized the bisulphuret of carbon, (which in the gaseous form is evolved by the decomposition of animal matter,) and deodorized the night-soil. This experiment was repeated in a pail of clean water, to which the foul odour was imparted by the bisulphuret of carbon, and removed by the application of the re-agent. Mr. Redwood next threw into the deodorized night-soil some phosphoret of calcium, upon which combustion instantly takes place, showing the immediate action of the re-agent upon the test.

The Marylebone Vestry having appointed a Committee "to investigate the properties of the several compounds now before the public as disinfectants or deodorisers," the Committee have made a report of their labours, from which we quote the following:—

"There are four compounds chiefly employed or recommended for the purposes in question, namely, chloride of lime; Sir William Burnett's liquid, or chloride of zinc; Leydoyen's, which is nitrate of lead; and Mr. Ellerman's, consisting of a preparation of iron.

"Chloride of lime has for many years been in use for destroying offensive odours, and is by some authorities considered a disinfectant. It has this disadvantage: that, in removing one odour, it imparts another, which, although not deleterious, is by no means agreeable.

"Chloride of zinc was introduced some years ago by Sir William Burnett, as an agent, for preserving woods, ropes, sailcloth, &c. from decay. It had recently been recommended for destroying offensive odours, and preventing contagion. The former of these properties it possesses, but in a less degree than chloride of lime; and further evidence is required to establish its claim to the character of a disinfectant.

"Ledoyen's fluid, which is a solution of nitrate of lead, has a specific action on noxious matters containing sulphuretted hydrogen and sulphuret of ammonium, which are the prevailing results of the decomposition of animal and vegetable matter. It has been used with success for depriving night-soil of its offensive effluvia, and is useful in hospitals, as a means of neutralising the odour of fæcal matter. It has been recommended for preventing contagion; but the evidence on this subject is not considered by the best authorities to be conclusive.

"Mr. Ellerman's fluid is also efficacious as a means of destroying the odour of night-soil, and other similar substances. It possesses also this advantage, that while it neutralizes the odour so as to admit of the soil being removed at any time without creating a nuisance, it does not in any degree interfere with the efficacy of such matters as manures. On the contrary, it rather tends to increase their fertilizing quality. It is also the least expensive of the four compounds above alluded to.

"In an experiment performed by your Committee with night-soil, it was found that Mr. Ellerman's fluid possessed a greater power than any of the others in destroying the smell, leaving merely a slight acid odour. Next in order, the chloride of lime was found to be efficacious, but the smell of the chloride was powerful, and continued for a considerable time. Sir W. Burnett's was less efficacious than the former fluid; and the nitrate of lead, although producing some effect, was less powerful than the others, a large quantity being requred to produced the desired result."

BROWN'S PATENT DISINFECTING PROCESSES AND ARTIFICIAL MANURES.

This invention consists, firstly, in neutralizing the odorous and noxious gases emanating from fæcal substances, or, "disinfecting" such substances, whereby they may be collected and preserved, in order to their being manufactured into carbonic compounds applicable as manures, without injury to the public health, or to the individuals engaged in such collection and manufacture; secondly, in converting the said fæcal substances into carbonic compounds applicable as manures; and, thirdly, in manufacturing carbonic compounds from the muscular flesh, blood, and offal of dead animals, and from the ammoniacal waste matters of various manufactories.

The substances employed for disinfecting are, either the sulphate of iron or the chlorides of sodium (sea-salt), or the chlorides of iron and manganese; or the nitrates, sulphates, and chlorides of lead, copper, zinc, and tin; or pyroligneous acid; or the pyrolignites of iron; or the mother-waters arising from the manufacture of any of the before-enumerated substances: or coal-tar; or schistous and bituminous extracts. Of these, preference is given to the sulphates and chlorides of iron. These are poured into the cesspool, or other receptacle, and the mass stirred together

with an absorbent powder; the cesspool must then be closed for about ten minutes, when the removal of the night-soil may be commenced, without fear of any unpleasant smell. For the mode of manufacturing the absorbent powder, and its use, as well as for the manufacture of the carbonic compounds, see the Patentee's specification, quoted in the *Mechanics' Magazine*, No. 1255. Now that the Public Health engages the attention of the legislature and scientific men, the above discovery is of considerable importance.

AIR AND WATER OF TOWNS.

Dr. R. A. Smith has drawn up a series of observations on the Air, Rain, and Well-water of Manchester, where he resides. The quantity of organic matter in rain-water, collected as it fell in a pure porcelain or platinum vessel, was so considerable that it could be perceived, on evaporating 500 grains to dryness, by its odour, and even its nitrogenised nature ascertained. Sulphates and chlorides were also present in sensible quantity; and the rain as it fell was always alkaline, showing an excess of bicarbonate of ammonia among the products of the combustion of coal used as fuel. When the water from a peaty district is boiled down and the ashes burned, the smell of peat is distinctly observed. But, as a river approaches a town, the smell from the burnt ash of the water changes, and organic matter from the decomposition of protein compounds is distinctly traced. The impurities of the well-water are found to be chiefly inorganic salts, among which nitrates prevail,—showing how rapidly organic matter is oxidized and converted into nitric acid in the soil.

NEW PROCESSES FOR MAKING WHITE LEAD.

Two new modes of making White Lead without injury to workmen, are described in the *Mining Journal*. One is that of M. Gannal, of France, who rotates granulated lead in an octagonal revolving cylinder with water till reduced to impalpable powder, when it is exposed to the air, and oxidates: after this, carbonic acid is introduced through a flexible tube, and converts the oxide into carbonate, or white lead, of dazzling whiteness, with two days' washing. The mass is lastly pressed on filtres, divided into pieces, and dried in stoves—into cakes, we presume; so that thus also, the equally serious evils experienced in the mere turning of the dry dust or powder over, into, or out of the barrels, &c., after it is made, may be obviated. The other mode of making it is that of Mr. R. C. Lotham, chemist, Craven-street, Strand, who submits lead to the action of the acid vapours evolved in the brewing process in air-tight chambers, heated by furnace until it is converted into carbonate; the workmen being thus protected from the fumes evolved during the process.

MEANS OF TESTING THE COMPARATIVE VALUE OF ASTRINGENT SUBSTANCES FOR TANNING. BY MR. ROBERT WARINGTON.

Mr. Warington has explained to the Chemical Society, the manipulation of testing the value of Astringent Substances imported into this country for the purposes of Tanning; such as valonia, divi-divi, sumac, cutch, &c. As the manufacture of the leather was the object of the pur-

chaser of these materials, gelatin was selected as the basis for the estimation of their comparative value; and after several trials with various kinds of natural and manufactured gelatin, such as varieties of isinglass, glue, patent gelatin, &c., the finest long staple isinglass was found to be the most constant in its quality, and least liable to undergo change.

With this, therefore, the test solution was prepared, of such a strength that each division, by measure in the ordinary alkalimeter tube, should be equivalent to the one-tenth or one-fourth of a grain of pure tannin, and thus the number of divisions used would indicate the proportion of available tannin or substance precipitable by gelatin contained in any specimen. A given weight of the sample under trial was then infused in water, or, if necessary, the astringent matter extracted by boiling, and the clear liquid precipitated by the test solution until no further deposit occurred.

It was necessary in the course of this operation to test at intervals a portion of the solution under examination, to ascertain the progress of the trial; and this, from the nature of the precipitate, was attended at first with some little difficulty: paper filters were inadmissible from the quantity of the solution they would absorb, and thus introduce a source of extensive error; subsidence rendered the operation very tedious. The plan adopted is as follows:—A piece of glass tubing, about twelve inches in length and about half an inch internal diameter, is selected; this has a small piece of wet sponge loosely introduced into its lower extremity, and when it is wished to abstract a part of the fluid under investigation for a separate testing, this is immersed a few seconds in the partially precipitated solution; the clear liquid then filters by ascent through the sponge into the tube, and is to be decanted from its other extremity into a test glass; if, on adding a drop of the gelatin solution to this a fresh precipitate is caused, the whole is returned to the original bulk, and the process proceeded in, and so on until the operation is perfected; this method of operating being facilitated by conducting the examination in a deep glass. After a few trials, the manipulation will be found extremely easy, and in this way considerable accuracy may be arrived at.—*From the Proceedings of the Chemical Society.*

READE'S PATENT INKS AND NEW SALTS OF GOLD.

The Rev. J. B. Reade, of Stone Vicarage, Aylesbury, has patented some processes for making Writing and Printing Inks—black, blue, and red—and also, Marking Inks, which the Editor of the *Mechanics' Magazine* states to be of a much superior quality to any yet known.

The present specification discloses processes for making both writing and printing inks—black, blue, and red—and also marking inks—of a much superior quality to any ket known. We say this advisedly, for, the patentee—unlike the majority of would-be improvers in this branch of manufactures—can give, and does give, *the sufficient reason* for the superiority which he claims in each case. His writing inks are superior, because they are proof both against acids and alkalies, and especially fit, therefore, for use with steel pens; his printing inks, because they are made mostly from the same materials as the writing inks, with the sub-

stitution of water for oil, and the addition of a few ingredients in perfect chemical harmony with the others; and his marking inks, because in one case the acid essential to this class of inks is neutralized, and in another, because the compound is such that it cannot be acted on by any of the common salts of silver, such as cyanide of potassium, or chloride of lime.

Some of Mr. Reade's processes will be new to the chemical world; his means, in particular, of obtaining a soluble prussiate of blue, which it will be seen affords some reason for believing that Davy was right, after all, in questioning the elementary character of iodine.

In the course of his experiments, Mr. Reade has discovered two new salts of gold, of a very interesting character, which he has named ammonio-iodide and ammonio-periodide of gold.

ANALYSES OF THE INORGANIC CONSTITUENTS OF ORGANIC BODIES.

Dr. de Veil has called the special attention of the British Association to the necessity of observing minutely the precaution recently insisted upon by Prof. H. Rose, in respect to the determination of the Inorganic Constituents of Organic Matter; as of the blood, for example. Dr. de Veil having made comparative statements for determining the quantity of inorganic matter in blood by the usual mode of incineration, and by that of Rose, which consists in treating the residue, after careful carbonization, with dilute hydrochloric acid, obtained one-fourth more inorganic matter by the latter than by the former process. This difference is very considerable, and ought especially to excite the attention of chemists engaged in the quantitative determination and analysis of the ashes of plants.

VEGETABLE POISONS.

M. C. Flandin has read to the Academy of Sciences, at Paris, a paper on Vegetable Poisons—in particular, Opium. It was divided into two parts. In the first, after observing that up to the present time no effectual means in chemistry have been discovered for the detection of vegetable poisons in the human body, he proposes the adoption of two new modes of analysis, both founded on two experimental facts:—1. That the immediate principles of vegetable poisons, such as morphine, narcotine, brucine, strychnine, &c., are not decomposed by their contact with animal matter at a temperature of 100 degrees of centigrade, or rather more; 2. That ammonia precipitates alkaline vegetables from their acid solutions up to and beyond the proportion of thousandth parts. He says: "One of the first facts that resulted from my experiments was that of very large doses of morphine being supported by all the above-named animals,—the base being perhaps decomposed or neutralized by the gastric juice under the influence of the vital force. I recalled to mind, on the one hand, that morphine is decomposed by certain strong acids,—azotic acid for instance; and, on the other hand, I have shown that the same decomposition results from the action of a chlorure or an alkaline chlorite united to a weak acid,—the chlorure of lime and chlorite of soda acting in presence or by the medium of acetic, oxalic, or tartaric acid, &c. &c. The result even of this last decomposition furnishes a new test, which must be added to those most valued for vegetable alkaline bases. Mor-

phine in this state gives a fine yellow colour, narcotine a red colour, and brucine a rose colour; strychnine undergoes no modification. Morphine may be decomposed or burnt during the digestive or respiratory process; but even if this be the case, all the morphine is not suddenly transformed or destroyed either in the digestive canal or in the circulation of the blood." The conclusion of M. Flandin, is that vegetable poisons, and particularly morphine, may be partly neutralized by contact with the fluids, or under the influence of the vital force; but that the portion which produces morbid effects, the portion which destroys life, remains in its natural state in the organs, and may be discovered with the aid of chemistry.—*Athenæum*, No. 1032.

ANALYSIS OF THE ASHES OF THE ORANGE-TREE.

Messrs. T. H. Rowney and H. How have communicated to the Chemical Society, the result of this analysis performed under the direction of Dr. Hofmann, in the laboratory of the Royal College of Chemistry. The following are the conclusions:—

The preceding analyses furnish a new confirmation of the fact first observed by De Saussure, namely, that the largest amount of mineral constituents is deposited in those parts of the plant in which the process of assimilation appears to be most active. While the ash left by the root, stem, fruit, and seed, did not exceed from 3 to 4 per cent., the leaves left not less than 13 per cent. of fixed residue on incineration.

Regarding the composition of the different ashes, the great amount of carbonic acid found in the ashes of the root, the stem, and the fruit, is at once obvious; proving that not only the fruit, but also the roots and stem, contain a large quantity of organic acids.

From the composition of the ashes of the root, the stem, and the leaves, the orange-tree belongs decidedly to the lime plants. In these three ashes the joint amount of lime and magnesia exceeds the quantity of the rest of the mineral constituents. In the ashes of the fruit and seed, however, the alkalies are as prevalent as they have been found in analogous cases. The amount of phosphoric acid (23·24) in the ash of the seed is considerable, as might be expected; still, it is inferior to the quantities (34·81 and 42·02) which Mr. Souchay found on analysing the seeds of the citron (*Citrus Medica*) and quince-trees (*Pyrus Cydonia*). Nevertheless, the ash of the orange-seed is very analogous in composition to the ashes of the last-mentioned seeds, as may be easily seen on comparing their analysis.—*Liebig's Annals*, liv. p. 343.

THE DIRECTIONS OF PLANTS.

Prof. Maccaire has presented to the British Association, a paper on this subject, of which the following are the points demanding most attention:—

1st. That the theories advanced to explain the curling up of tendrils do not agree with the experiments made on those of the *Tamus communis*, and that it is the result of a vital irritability acted upon by chemical agents. 2nd. That the direction of the green parts of plants towards the light is not the result of an attraction properly so called. 3rd. That the bending

outwards of slip stems is due to the elongation of the cellular tissue by endosmose of water and the resistance of the cuticle. 4th. That the quantity or quality of endosmose is not influenced by heat or light. 5th. That light is the only agent of the natural position of the leaves, and of their turning over when inverted. The blue rays are the most, and the red the least, active rays. 6th. That light does not act in this case by a physical attraction or repulsion, properly so called. 7th. That the turning over of leaves takes place sometimes by a torsion of the footstalk; sometimes by a curling of the flat part of leaves. 8th. The blue ray appears to be the most, and the red the least, active in operating the turning over of leaves. 9th. That the exhalation of leaves is much increased when their inferior surface is exposed to light. 10th. That the decomposition of carbonic acid and the disengagement of oxygen gas are under the same circumstances considerably diminished.

INFLUENCE OF LIGHT ON THE GROWTH OF PLANTS.

Mr. R. Hunt, in his Report to the British Association, confirms the conclusions, that seeds will not germinate under the influence of light separated from the chemical principle with which it is associated in the sunbeam; that germination being effected, and the first leaves formed, light—the luminous rays—become essential to the plant to enable it to secrete the carbon obtained from the carbonic acid of the atmosphere; and that the increased action of the heat rays are essential to insure the production of the reproductive elements of vegetable life. It is found that the chemical principle of the solar rays is more active, relatively to heat and light, during the spring, than at any other period of the year: that as summer advances this power diminishes and luminous force increases, whilst with the autumn both light and actinism are subdued, but the calorific radiations increased. Thus we find the conditions of the light of the seasons varying to suit the necessities of vegetable life. The production of chlorophyl, or the colouring matter of the leaves, was shown to be due to the joint action of light and actinism; the first being necessary to effect the secretion of the carbon, and the latter for the oxidation of this deposited carbon.

COLOURED GLASS IN THE NEW PALM-HOUSE, ROYAL BOTANIC GARDEN, KEW.

Mr. R. Hunt, in a paper read to the British Association, states, that it has been found that plants growing in stove-houses often suffer from the scorching influence of the solar rays, and great expense is frequently incurred in fixing blinds to cut off this destructive calorific influence. From the enormous size of the new Palm-house at Kew, it would be almost impracticable to adopt any system of shades which should be effective—this building being 363 feet in length, 100 feet wide, and 63 feet high. It was, therefore, thought desirable to ascertain if it would be possible to cut off these scorching rays by the use of a tinted glass, which should not be objectionable in its appearance; and the question was, at the recommendation of Sir Wm. Hooker and Dr. Lindley, submitted by the Commissioners of Woods, &c., to Mr. Hunt. The object was, to select a glass

which should not permit those heat rays which are the most active in scorching the leaves of plants to permeate it. By a series of experiments made with the coloured juices of the palms themselves, it was ascertained that the rays which destroyed their colour, belonged to a glass situated at that end of the prismatic spectrum which exhibited the utmost calorific power. and just beyond the limits of the visible red ray. A great number of specimens of glass variously manufactured were submitted to examination, and it was at length ascertained that glass tinted green appeared likely to effect the object desired most readily. Some of the green glasses which were examined obstructed nearly all the heat rays; but this was not desired, and from their dark colour these were objectionable, as stopping the passage of a considerable quantity of light, which was essential to the healthful growth of the plants.

Every sample of glass was submitted to three distinct sets of experiments:—1st. To ascertain, by measuring off the coloured rays of the spectrum, its transparency to luminous influence. 2nd. To ascertain the amount of obstruction offered to the passage of the chemical rays. 3rd. To measure the amount of heat radiation which permeated each specimen. The chemical changes were tried upon chloride of silver, and on papers stained with the green colouring matter of the leaves of the palms themselves. The calorific influence was ascertained by a method employed by Sir John Herschel in his experiments on solar radiation. Tissue paper stretched on a frame was smoked on one side by holding it over a smoky flame, and then, while the spectrum was thrown upon it, the other surface was washed with strong sulphuric ether. By the evaporation of the ether, the points of calorific action were most easily obtained, as these dried off in well-defined circles long before the other parts presented any appearance of dryness.

By these means it was not difficult, with care, to ascertain exactly the conditions of the glass, as to its transparency to light, heat, and chemical agency (actinism). The glass thus chosen is of a very pale yellow green colour, the colour being given by oxide of copper, and is so transparent that scarcely any light is intercepted. In examining the spectral rays through it, it is found that the yellow is slightly diminished in intensity, and that the extent of the red ray is affected in a small degree, the lower edge of the ordinary red ray being cut off by it. It does not appear to act in any way upon the chemical principle, as spectral impressions obtained upon chloride of silver are the same in extent and character as those procured by the action of the rays which have passed ordinary white glass. This glass has, however, a very remarkable action upon the non-luminous heat-rays, the least refrangible calorific rays. It prevents the permeation of all that class of heat-rays which exists below and in the point fixed by Sir William Herschel, Sir H. Englefield, and Sir J. Herschel, as the point of maximum calorific action. As it is to this class of rays that the scorching influence is due, there is every reason to conclude that the use of this glass will be effective in protecting the plants; and, at the same time, as it is unobjectionable in point of colour, and transparent to that principle which is necessary for the develapement of those parts of the plant which depend upon external chemical

excitation, it is only partially so to the heat-rays, and it is opaque to those only which are the most injurious.

The absence of the oxide of manganese, commonly employed in all sheet glass, is insisted on, it having been found that glass, into the composition of which manganese enters, will, after exposure for some time to intense sun-light, assume a pinky hue, and any tint of this character would completely destroy the peculiar properties for which this glass is chosen. Melloni, in his investigations on radiant heat, discovered that a peculiar green glass, manufactured in Italy, obstructed nearly all the calorific rays; we may, therefore, conclude that the glass chosen is of a similar character to that employed by the Italian philosopher. The tint of colour is not very different from that of the old crown glass; and many practical men state, that they find their plants flourish much better under this kind of glass than under the white sheet glass, which is now so commonly employed—*Athenæum*, No. 1028.

ON NITRIC MANNITE. BY M. SOBRERO.

Since the action of nitric acid on organic bodies has been studied, a number of substances, of great interest to science, have been discovered; but the arts have hitherto acquired only fulminating-cotton, the fate of which is as yet uncertain. Whilst the question as to cotton is under consideration, M. Sobrero has announced another body which is fulminating in the highest degree, resulting from the action of nitric acid upon mannite—the Nitric Mannite, the composition of which has been given by MM. Flores Domonte and Ménard.

Fulminating Mannite possesses the property of detonating by the stroke of a hammer with as much violence as fulminate of mercury, and produces, during its decomposition, sufficient heat to inflame gunpowder. As soon as the author was acquainted with this property, he set about to apply it, and prepared capsules with it, instead of detonating mercury, for the discharge of fire-arms, and a fowling-piece was discharged by it.

With respect to its use, the author has arrived at the following conclusions:—

1. Fulminating Mannite must always be cheaper than fulminating mercury.

2. It is more conveniently prepared, and does not expose the workmen to the great danger which attends the manufacture of fulminating mercury.

It must be cheaper than fulminating mercury, because the price of Manna is not very high; because in the prepartion of Mannite an uncrystallizable residue is obtained, mixed with a little Mannite, which may be employed in medicine and the veterinary art as a purgative; and because, according to the analyses of MM. Flores Domonte and Ménard, the mannite, in becoming nitric mannite, must increase considerably in weight (from 100 to 225).

It is less dangerous in preparation and manipulation: in fact, the preparation is merely accompanied with the disengagement of some vapour of nitric acid.

Fulminating Mannite requires for detonation a violent blow between

two hard bodies; heat gradually applied to it fuses and afterwards decomposes it, but without detonation. In fact, it may be placed on paper and touched with a red-hot coal, and fused without detonation; the paper on which it is put may be burnt, and it is decomposed without detonation.

Lastly, Fulminating mannite is decomposed by the blow of a hammer, without, as far as appears, producing nitrous vapours. It seems to be entirely decomposed into carbonic acid, water, and azote; besides which it keeps indefinitely, without undergoing decomposition.—*Comptes Rendus*, Juillet 19, 1847; *Philosophical Magazine*, No. 208.

NEW VEGETO-ALKALI IN GUN-COTTON.

Mr. R. Porrett has discovered that the hyponitrous acid in Gun-cotton is neutralized by an alkali, for which he proposes the name *Lignia*, and he believes that it opens a wide field for scientific research.

Mr. Porrett suspects that in the natural decay of woody fibre from leaves and rotting plants, this alkali is produced in combination with acetic acid, and that the acetate of lignia so formed exists in the sap of all vegetables; further, that it is decomposed and deoxidated by light acting on the leaves and bark of trees, reproducing lignia for the assimilation and growth of the plant: its action also on the animal system deserves inquiry.

NEW LIGHT FOR OPTICAL PURPOSES.

Mr. Children, F.R.S., in a letter to Mr. Richard Taylor, in the *Philosophical Magazine*, describes a New Light, which he has obtained by throwing the flame of spirit of wine on a surface of quicklime by a current of oxygen gas, something after the manner of Lieut. Drummond's original experiment. The illumination by the flame of spirit of wine alone, however, proved to be too feeble; but by mixing a portion of camphine (spirit of turpentine) with it (which readily dissolves in alcohol), in the proportion, by measure, of one part of camphine to eight parts of spirit of wine of the sp. gr. of ·841 at 60° F. (equivalent to the spirit of commerce of 60°), from which was obtained a light sufficient not only for dissolving views, but also for a microscope and physioscope, and perfectly free from all danger, or even possibility of explosion. This was proved on a screen about 22 by 18 feet, and if it were twice as large, the light is quite capable of illuminating it brilliantly; and it shows a microscopic object, magnified from half an inch to 30 feet, or 720 times, linear, with great distinctness and beauty. Measured by one of Wheatstone's photometers, this light was found equal to that of 76 of Brecknell and Turner's best platted-wick wax candles; and in other trials with thoroughly well and recently burnt lime (an essential caution), it was found quite equal to 108 or even 120 of the same candles.

In these experiments, no portion of the rays from either of the lights was intercepted; the object being to ascertain the comparative illuminating power of their entire surfaces, and not their comparative intensities only.

Were it not for the peculiar odour of the so-called naphtha or coal-oil, which to some persons is highly offensive, even in its purest state, it

might, when highly rectified, be advantageously substituted, in an economical point of view, for the spirit of wine. Four ounces of camphor dissolved in a pint of that liquid, give, under the same circumstance, nearly as brilliant a light as the spirit and camphine.

The light from camphine alone is for a few seconds intensely brilliant, but it is soon quenched in the enormous mass of unburnt carbon, which partly condenses on the lime and partly escapes into the atmosphere; filling the whole apartment with a dense and almost suffocating cloud of floating black particles. A sufficient and well-regulated supply of oxygen gas might perhaps remedy this defect.

The apparatus consists of a copper lamp with two tubes lying close together, and each containing a wick formed of flat cotton rolled up into a cylinder; and a cylinder of lime, about three-eighths of an inch long and one-eighth of an inch in diameter, inclosed in a thin copper case. The pipe conveying the oxygen gas from the gasometer terminates in a small jet, inclining upwards, which lies between the two wicks slighty parted to receive it, and within rather less than one-eighth of an inch from the circular disc of lime, and about one-fourth of an inch above the lower edge of the copper case.

Mr. Collins, philosophical instrument-maker to the Royal Polytechnic Institution, makes lanterns for dissolving views and microscopes, fitted up with the spirit and camphine light, and will be happy to show its effect to any gentleman who may wish to see it. His address is "26, Francis-street, Tottenham Court-road," and at the Polytechnic Institution.

CHEMICAL ACTION OF LIGHT.

Mr. Kilburn, of Regent Street, has communicated to the *Philosophical Magazine*, No. 202, the following highly remarkable effects of the Chemical Action of Light.

I have been successful in obtaining well-defined photographic impressions on highly sensitive Daguerréotype plates, on which the object, when illuminated by a common *dip* candle, was impressed in ten minutes; with the smallest fish-tail burner of coal gas in three minutes; and by the oil lamp, viz., a solar lamp, in the same time. I include each flame in the picture by which they have recorded their size, and to some extent their illuminating power.

INFLUENCE OF SUNSHINE.

Mr. R. Hunt has conclusively established by experiment, that precipitation takes place in all metallic solutions more rapidly in the light than in the dark; all other circumstances being the same, the luminous rays appear, however, to have nothing to do with the change. The precipitation is as much suspended while under the full influence of the yellow ray as an absolute darkness; but within, and even beyond the dimly lighted end of the spectra, the precipitation is very rapid.

IMPROVED PHOTOGRAPHIC PROCESSES.

THE following are among the principal results of the past year:—

Solar Radiations and Coloured Media.—Mr. Claudet has found, that when the sun is rendered red by the vapours of the atmosphere, not only it produces no effect upon the Daguerréotype plate, but that it destroys the effect previously produced by white light. If the image of the red sun be taken in the camera obscura, it produces upon the Daguerréotype plate a black image. By covering a Daguerréotype plate previously affected by light, with a red, orange, or yellow glass, the radiation through these coloured media has also the property of destroying the action produced by white light. The most interesting part of Mr. Claudet's paper refers to the fact, that after the destroying action of the red, orange, and yellow radiations, the plate is restored to its former sensitiveness; so that, after having been affected by white light, and restored by the destructive action of the red, orange, and yellow radiations, it is possible to produce a photogenic effect as upon a plate just prepared with iodine and bromine. This alternate acting and destroying action may be repeated *ad infinitum*, without altering the final state of the plate. This curious fact proves evidently, that in the Daguerréotype process, light does not alter the chemical compound on the plate, and that the affinity for mercury is the result of some new property imparted by the action of the rays of light. Mr. Claudet's experiments prove also, that the red and yellow rays are endowed with a photogenic action of their own, which, as well as that of the blue and violet rays, gives an affinity for mercurial vapour, The photogenic action of the red ray is destroyed by the yellow, that of the yellow by the red; the red and yellow destroy the photogenic action of the blue, and the blue destroys the action of the others. The photogenic, or the destroying, action of any particular ray cannot be continued by any other. It appears, therefore, that each radiation changes the state of the plate, and each change produces the sensitiveness to mercurial vapour when it does not exist, and destroys this sensitiveness when it does exist.—*Proc. British Association; Literary Gazette*, No. 1589.

Coloured Photography.—Specimens by Mr. Kilburn have been exhibited to the Society of Arts. The colours are employed in the form of an impalpable powder, which is made to adhere to the plates by amalgamation with the mercury composing the picture, and being finer than the grain of that deposit. The specimens exhibited had a miniature background composed of sky and landscape. This the author stated to be entirely new, and gives effect to the portrait by throwing the figure forward, destroying much of the metallic reflection, and admitting of as great variety as the subjects may require.

The Chromatype discovered by Mr. Hunt is described as the most certain process. It consists in washing good letter-paper with the following solution:—

Bi-chromate of potash	10 grains.
Sulphate of copper	20 grains.
Distilled water	1 ounce.

Papers prepared with this are of a pale yellow colour; they may be kept for any length of time without injury, and are always ready for use.

For copying botanical specimens or engravings, nothing can be more beautiful. After the paper has been exposed to the influence of sunshine, with the objects to be copied superposed, it is washed over in the dark with a solution of nitrate of silver of moderate strength. As soon as this is done, a very vivid positive picture makes its appearance; and all the fixing these photographic pictures require is, well washing in pure water.

Copying Brasses.—Mr. Alfred Taylor has described to the College of Chemistry, the application of Daguerréotpye to the copying of sepulchral brasses; and exhibited a Daguerréotype impression of the rubbing of an ancient sepulchral cross of the time of Edward III. (1375)—and one of the best specimens of a sepulchral tablet extant. It was that of a priest represented in his robes; the figure between five and six feet in length. The lines of the tool employed in engraving are as sharp, even in the most minute ornamental parts of the manciple and stole, as if the tablet were of recent date; hence it admitted of a perfect copy being taken by the ordinary mechanical process of rubbing. From a copy thus taken on paper, the figure was transferred to a silver plate by means of Professor Highschool's camera. Although the figure in the silver plate is only about three inches in length, the minutest traces of the graver are brought out; and every line is represented with the most perfect accuracy, including the remains of the old English inscription.

Copying Writing, Drawing, &c.—M. Niepce de St. Victor finds, that if a sheet of paper on which there is writing or printed characters, or a drawing, be exposed for a few minutes to the vapour of iodine, and there be applied immediately afterwards a coating of starch moistened by slightly acidulated water, a faithful tracing of the writing, printing, or drawing, will be obtained. M. Niepce has also discovered that a great number of substances, such as nitric acid, phosphoric acid, chlorurets of lime and mercury, &c., act in a similar manner, and that various vapours, particularly those of ammonia, have the effect of vivifying the images which are obtained by photography.

Copying Microscopic Objects.—Dr. Carpenter has exhibited to the British Association, numerous specimens of Daguerréotype and other photographic copies of very delicate microscopic objects, peculiarly beautiful, and obtained by the solar microscope, the object being thrown upon the paper or the plate, instead of upon the ordinary screen. The minuteness of these copies was far beyond anything obtainable by the artist; and the care with which they were produced, particularly on photographic paper, recommended this application of the art to the attention of naturalists.

Fixing Photographs.—M. Regnault has laid before the Academy of Sciences, at Paris, some photographic specimens on paper, obtained by M. Blanquart-Evrard by a modification of the usual process. In the preparations hitherto described, one part of the process presented serious difficulties, viz. that of the use of gallic acid in order to produce the impression. It happened frequently that a proof taken in too mild a light, or of too large dimensions, could not receive the necessary force before disappearing—as it may be said—under the uniform colour produced by the mixture of the gallic acid with the aceto-azotate of silver with which

the paper is imbued. After having ascertained that the gallic acid produces this uniform colour on the impression only because it is combined in small quantity with the aceto-azotate of silver, M. Blanquart-Evrard removes all the difficulty by replacing the original mode of operating by a bath. After taking the proof from the camera obscura, he plunges it into a vessel of large dimensions, covered with a layer of one centimètre of gallic acid of cold saturation. The bath is agitated during the immersion; and the action may be thus prolonged until the impression has obtained the necessary force to secure a good result. The proof is then washed, and the gallic acid is replaced by a solution of bromure of potassium, or chloruret of sodium, in which it is left for about a quarter of an hour.—*Athenæum*, No. 1050.

Restoration of Photographs.—Mr. Brooke has found that an impression made on paper prepared with the bromide of potassium and nitrate of silver gradually passed away, so that at the end of ten or twelve hours very little evidence of actinic action could be detected. In preparing highly sensitive papers, Mr. Brooke has found that the addition of a very small quantity of iodide of potassium to the solution of bromide of potassium very materially improves the sensibility of the preparation.

GUN COTTON.

In the *Year-book of Facts*, 1847, we gave a *resumé* of the Origin and Introduction of this new explosive power, together with a notice of the claimants of the invention; experiments to test its powers; its analysis, and chemical constitution. Upon each of these heads we now give additional investigations, undertaken during the past year.

M. Schönbein's Analysis gives the following results:

	Experiment.	Calculation.
Carbon	27·43	28·1
Hydrogen	3·54	3·1
Azote	14·26	14·5
Oxygen	54·77	54·3

According to M. Ballot's analysis, pure xyloidine is composed of

	Experiment.	Calculation.
Carbon	37·29	37·31
Hydrogen	4·99	4·84
Azote	5·17	5·76
Oxygen	52·55	52·09

The slightest attention, Prof. Schönbein says, will suffice to show that the composition of gun-cotton differs considerably from that of xyloidine; that it is a compound poorer in carbon and richer in oxygen than the discovery of Braconnot; that consequently in burning, it ought to produce more gas, have a greater explosive force, and leave less residue than xyloidine.

The differences between these two substances are likewise displayed in other properties: for instance, xyloidine, especially at a high temperature, is dissolved by concentrated vinegar, and when water is added it separates again unaltered; gun-cotton is insoluble in this acid. At the temperature of boiling water, xyloidine dissolves in hydrochloric acid (sp. gr. 1·12), and in nitric (sp. gr. 1·38) into a colourless liquid, whence water cannot

separate xyloidine. Gun-cotton is entirely indifferent to this acid. Xyloidine inflames at a temperature of C. 180°: gun-cotton exposed to a temperature of

210° inflames instantaneously.
200° „ at the end of 12 seconds.
175° „ „ 30 „
150° „ „ 12 minutes.
130° does not inflame at all.

M. Schönbein's Specification.—Of the specification of this patent (taken out in the name of Mr. John Taylor, of the Adelphi,) the following is a correct abstract:—

The patentee states that the invention consists in the manufacture of explosive compounds applicable to mining purposes and to projectiles, and as substitutes for gunpowder, by treating and combining matters of vegetable origin with nitric and sulphuric acids.

The matter of vegetable origin which he prefers, as being best suited for the purposes of the invention, is cotton, as it comes into this country, freed from extraneous matters; and it is stated to be desirable to operate on the clean fibres of the cotton in a dry state.

The acids are, nitric acid of from 1·45 to 1·50 specific gravity, and sulphuric acid of 1·85 specific gravity.

The acids are mixed together in the proportion of 1 measure of nitric acid to 3 measures of sulphuric acid, in any suitable or convenient vessel not liable to be affected by the acids. A great degree of heat being generated by the mixture, it is left to cool until its temperature fall 60 or 50 degrees Fah. The cotton is then immersed in it; and, in order that it may become thoroughly impregnated or saturated with the acids, it is stirred with a rod of glass or other material not affected by the acids. The cotton should be introduced in as open a state as practicable. The acids are then poured or drawn off, and the cotton gently pressed by a presser of glazed earthenware, to press out the acids, after which it is covered up in the vessel, and allowed to stand for about an hour. It is subsequently washed in a continuous flow of water, until the presence of the acids is not indicated by the ordinary test of litmus paper. To remove any uncombined portions of the acids which may remain after the cleansing process, the patentee dips the cotton in a weak solution of carbonate of potash, composed of 1 ounce of carbonate of potash to 1 gallon of water, and partially dries it by pressing, as before. The cotton is then highly explosive, and may be used in that state; but, to increase its explosive power, it is dipped in a weak solution of nitrate of potash, and, lastly, dried in a room heated by hot air or steam to about 150 degrees Fah.

It is considered probable that the use of the solutions of carbonate of potash and nitrate of potash may be dispensed with, although actual experience does not warrant such an omission.

The patentee remarks, that nitric acid may be employed alone in the manufacture of explosive compounds; but that, as far as his experience goes, the article when so manufactured is not so good, and far more costly.

When used, care should be taken to employ a much less quantity by weight, to produce the same result, than of gunpowder; and it has been found that three parts by weight of the cotton produce the same effect as eight parts by weight of the Tower-proof gunpowder.

The cotton, when prepared in the manner before mentioned, may be rammed into a piece of ordnance, a fowling-piece, or musket; or may be made up into the shape of cartridges; or may be pressed, when damp, into moulds of the form of the bore of the piece of ordnance for which it is intended, so that when dried it shall retain the required figure; and it may also be placed in caps like percussion caps, and made to explode by impact. Lastly, the patentee states, that although he prefers the use of cotton, other matters of vegetable origin may be similarly treated with acids to form an explosive compound, and that acids of an inferior specific gravity may be employed.

Improved Preparation.—Mr. Coathupe has forwarded to the Chemical Society, two specimens of Gun-cotton, with a view to illustrate the greatly increased explosive effects that are to be derived from a subsequent immersion of the gun-cotton, when properly prepared in the ordinary way, in a saturated solution of chlorate of potash. Mr. Coathupe states:—"Having experimented with solutions of nitrate of ammonia, nitrate of potash, nitrate of soda, bichromate of potash, &c. &c., for the purpose of increasing the explosive properties of this interesting substance, I can affirm that none of the results will bear the slightest comparison with those obtained from the solution of chlorate of potash, either in rapidity of ignition or in intensity of flame. The process adopted for preparing the inclosed specimens was as follows; viz. into a mixture of equal measures of strong *nitrous* acid and of oil of vitriol, spec. grav. 1·845, the cotton was immersed and stirred with a glass rod during about three minutes; it was then well washed in many waters, and dried; a portion of it was then soaked for a few minutes in a saturated solution of chlorate of potash, well squeezed and dried,"

Singular property of Gun-cotton Mixture.—Dr. Draper has made the following observations:—Lecturers on chemistry have known for a long time, that one of the best methods of illustrating the properties of carbonic acid gas, is to evolve it from carbonate of ammonia by the action of monohydrated nitric acid. A dense white fume accompanies the gas, and marks all its movements in a striking manner.

Commercial nitric acid fails to produce the same effect. It sets the gas free in an invisible state. But if a mixture of commercial nitric acid and oil of vitriol be used, then the dense fume is at once produced. The explanation seems to be, that the oil of vitriol, by retaining water, allows some of the carbonate of ammonia to pass off with the carbonic acid in a dry state, and hence gives the gas a smoky aspect.

But it is singular, that though oil of vitriol will, of course, decompose carbonate of ammonia very rapidly, the gas which escapes is transparent.

Dr. Ellet, of South Carolina College, has published a process for preparing gun-cotton, which is, unquestionably, the greatest improvement yet made in the preparation of that explosive substance. His plan is to soak cotton in a mixture of oil of vitriol and saltpetre, and then wash it tho-

roughly from the adhering salt. Now, if this mixture of oil of vitriol and saltpetre be made to act on carbonate of ammonia, like monohydrated nitric acid, or common nitric acid mixed with sulphuric, it evolves carbonic acid in the smoky state.—*Philosophical Magazine*, No. 201.

Explosion.—Mr. Ransome has proved, by experiment, that Gun-cotton will explode without the presence of oxygen, and also under the same circumstances that carbonic oxide is formed, but no nitric oxide.—*See Philosophical Magazine*, No. 198.

Experiments in Blasting.—Several experiments have been made in railway and mining works; we have not room for the details, but quote the results. Thus, in the Geeson cutting, near Stamford, on the Syston and Peterborough railway, through a hard freestone foundation, about five feet thick, entire depth twenty-eight feet, experiments showed the average powers of the gun-cotton to be in the proportion of one of gun-cotton to six of gunpowder; so that, where six holes are necessary when powder is used, only one hole is necessary when the gun-cotton is substituted, whereby a great saving of time, labour, and expense in all blasting operations, whether in open cuttings, tunnels, or deep mines, is effected.

In the slate quarries at Penrhyns, the suitability of gun-cotton in blasting slate has been proved to be far superior to that of gunpowder. Thus, the huge mass of sixty tons weight was gently pushed from its firmly-bound bed by the explosion of only eight ounces of cotton, with no splintering of the slate.

In some experiments made at the Washington Arsenal, United States, gun-cotton produced in the musket an effect equal to about twice its weight of good rifle powder. This cotton leaves a small quantity of a dark-coloured residuum in the musket barrel, extending from the breech to about half the length of the barrel; this residuum is easily removed by wiping the barrel with a rag. The combustion of the gun-cotton is unattended with smoke; the report made by it is sharper than that produced by gunpowder.

Advantages and Disadvantages of Gun-cotton in Fire-Arms.—These have been thus summed up by Professor Brande, in a paper read by him to the Royal Institution. The disadvantages are:—that the effects are less regular than those of gunpowder; that it is more dangerous, because inflaming at a lower temperature; that it does not take fire when compressed in tubes; that it burns slowly in all kinds of cartridges; that guns and pistols must be altered to admit of its use; that it is not adapted for the use of the army; that the barrel of the gun is moistened by the water produced during combustion. The advantages, on the other hand, may be stated as follows:—Its extreme cleanliness, leaving no residue after combustion; its freedom from all bad smell; the facility and the safety of its preparation; the possessing treble the force of gunpowder; its explosion producing no smoke and less noise than that of gunpowder; its filamentary nature admitting of its being used overhead in mining operations; its not being liable (as a granulated substance is) to the accidents of leakage; its occasioning very little recoil.—*Athenæum*, No. 1004.

The Board of Ordnance have definitively decided against the adoption of this explosive compound in the military and naval services. The chief

objection to it is the very low temperature at which it explodes. The mere heating of a gun from a number of charges fired in succession, has been found sufficient to cause an instant explosion of gun-cotton.

DETECTION OF COTTON IN LINEN.

This subject has frequently engaged the attention of commercial men: many experiments have been made, in order to detect cotton-thread in linen; many processes have been recommended, but none have hitherto proved satisfactory.

Mr. G. C. Kindt, in experimenting with explosive cotton, flax, &c., observed that these two substances behave somewhat differently towards concentrated acids; and although it has long been known that strong sulphuric acid converts all vegetable fibre into gum, and when the action is continued for a longer period, into sugar, M. Kindt found that cotton was metamorphosed much more rapidly by the sulphuric acid than flax. It is, therefore, by means of *concentrated sulphuric acid* that cotton may be removed from linen when mixed with it; and this object may be obtained by the following process:—

The sample to be examined must be freed as perfectly as possible from all dressing by repeated washing with hot rain or river-water, boiling for some length of time, and subsequent rinsing in the same water; its entire removal being requsite for the experiment to succeed. When it has been well dried, the sample is dipped for about half its length into common oil of vitriol, and kept there for about half a minute to two minutes, according to the strength of the tissue. The immersed portion is seen to become transparent. It is now placed in water, which dissolves out the gummy mass produced from the cotton; this solution may be expedited by a gentle rubbing with the fingers; but since it is not easy to remove the whole of the acid by repeated washing in fresh water, it is advisable to immerse the sample for a few instants in spirits of hartshorn (purified potash or soda have just the same effect), and then to wash it again with water. After it has been freed from the greater portion of the moisture by gentle pressure between blotting-paper, it is dried. If it contained cotton, the cotton-threads are found to be wanting in that portion which had been immersed in the acid; and by counting the threads of the two portions of the sample, its quantity may be very readily estimated.

If the sample has been allowed to remain too long in sulphuric acid, the linen threads likewise become brittle, or even eaten away; if it were not left a sufficient time in it, only a portion of the cotton threads have been removed; to make this sample useful, it must be washed, dried, and the immersion in the acid repeated. When the tissue under examination consists of pure linen, the portion immersed in the acid likewise becomes transparent, but more slowly and in a uniform manner, whereas in the mixed textures the cotton threads are already perfectly transparent, while the linen threads still continue white and opake. The sulphuric acid acts upon the flax threads of pure linen, and the sample is even somewhat transparent after drying as far as the acid acted upon it, but all the threads in the sample can be seen in their whole course.

Cotton stuffs containing no linen dissolve quickly and entirely in the acid; or if left but one instant in it, become so brittle and gummy that no one will fail to recognise it as cotton when treated in the above manner.—*Liebig's Annalen; Philosophical Magazine*, No. 206.

NEW TEST FOR ARSENIATES.

Dr. R. D. Thomson, in the *Philosophical Magazine*, No. 208, notices a simple and quick method of testing minerals containing Arsenic in its various forms, phosphates, molybdates, vanadiates, &c. A few grains of the mineral to be examined are to be finely pulverized in an agate mortar and introduced into a test-tube, and boiled with bisulphohydret of ammonia for a few minutes. The mineral is partially decomposed; the sulphuret of lead precipitates, while sulphuret of arsenic, &c., is dissolved by the excess of the re-agent. The tube is then allowed to stand at rest, and the supernatant liquor poured off or filtered. The excess of bisulphohydret of ammonia being removed by evaporation, the yellow sulphuret of arsenic precipitates. A molybdate is detected at once by the fine orange-red colour which the re-agent assumes when it is heated in contact with that mineral.

A vanadiate gives a dark colour, but possessing less of the red shade than the molybdate. The liquor filtered from the sulphuret of lead containing the vanadium in solution has a green colour, becoming blue by the addition of hydrochloric acid. Hence, it appears that arsenic dissolved in bisulphohydret of ammonia does not alter the colour of that re-agent, while the liquor gives a precipitate of orpiment by concentration. Molybdenum and vanadium, on the other hand, render that reagent reddish, and give brown precipitates by concentration. The liquor filtered from the sulphuret of molybdenum is colourless, or its hue is similar to that of the reagent, while the liquor derived from the vanadium precipitate is *green*.

Dr. Thomson has succeeded in decomposing a sufficient amount of these minerals for quantitative analysis by the preceding process, when they have been carefully pounded and levigated. The process is particularly advantageous in the analysis of molybdate of lead, where the use of nitric acid for dissolving the mineral is objectionable in consequence of its tendency to form the molybdate of molybdenum, and where hydrochloric acid, by producing a chloride of lead, renders the employment of an inconvenient quantity of water necessary. Dr. Thomson has found this process for testing very convenient where it was desirable to use minute quantities of crystals, and where rapidity is an object in view, as in examining a large collection of minerals of the preceding description.

The bisulphohydret affords a simple distinguishing test between metallic arsenic and antimony, when spots have been received on porcelain by Marsh's process. Arsenic dissolves in the reagent, and leaves a yellow stain by evaporation. Antimony dissolves and leaves an orange stain. For this experiment it is convenient to use the inside of the cover of a porcelain crucible.

Natural History.

ZOOLOGY.

COLONIZATION OF AMERICA AND POLYNESIA.

If any ethnographic similitudes do exist between America and Poylnesia, they may be safely considered as common results of one and the same cause. Though the new world must have received inhabitants from the old, across the strait which separates them, just as certainly as if the two were connected by an isthmus, yet it might, in all probability, have received others, and those too, in more regular and continuous streams, along the chain of stepping-stones, which extend from China to the north-west coast, comprehending Japan, the Kurile Islands, and the Aleutian Archipelagos; and to show that this supposition is far within the limits both of possibility and probability, a Japanese junk, such as has been used since the first settlement of this country, lately found its way to the western shores of the new continent, with a living crew on board, and without the aid of any intermediate place of refreshment or rest. In a word, America and Polynesia appear to have been chiefly, if not solely, colonized from one and the same general region of Eastern Asia.—*Narrative of a Journey round the World, by Sir George Simpson*, vol. ii.

ANIMALS OF THE OLD AND NEW WORLD.

Mr. J. W. Dawson observes, (in *Jameson's Journal*, No. 84,) "It may be remarked, in general, that there is no animal, frequenting in Europe the cultivated grounds, and either beneficial or noxious to man, which has not indigenous species in America, an exact representative, filling its place in the economy of nature, and often, in a natural historical point of view, closely related to it. This results from the general sameness of arrangement in the system of nature in the old and new world; and if studied in its details, would form a subject of great interest to the zoologist and physical geographer."

LOST SPECIES OF ANIMALS.

M. Marcel de Serres, in a paper communicated to the *Bibliothèque Universelle*, observes that if we adopt the interpretation admitted by a great number of Bible commentators, the Lost Species of Animals would be those which were destroyed by the deluge, as mentioned in the 21st, 22nd, and 23rd verses of the eighth chapter of Genesis. There is no need of very extraordinary causes to produce the destruction of a great number of living species, since there are many belonging to the existing creations, and of which we now find no traces on the earth, although certain of them were seen in times not very distant from our own.

Such is the case with the Dodo, which was seen in 1616, in the Island of Mauritius and in Bourbon, and of which some remains exist in the Museums of London, Oxford, and Leyden*. We no longer find this bird; and since that time it has not been observed elsewhere. The race is now,

* It even appears that the Paris Museum contains some remains of it.

therefore, extinct, as appears to be the case with that of the gigantic horned stag.

Yet, this ruminant was represented in the pictures of ancient Rome, and, according to the writers of antiquity, it was sent from England on account of the delicacy and excellence of its flesh. The same animal was known to Oppian, Jonston, Aldrovandus, and Munster, who appear to have seen it alive; the latter even pretends that he ate of it, which would prove that the species was not extinct in 1550.

The bone of a gigantic stag, presenting a callosity produced by a pointed and cutting instrument, and found by Mr. Hart in the Vale of Arno in Italy, confirms the report of these writers, or, at least, demonstrates that the destruction of this animal has taken place prior to historical times.

The Dinornes are likewise birds of which we know no representatives now living. They belong, however, to our epoch, for their nests have been discovered on the coasts of New Holland. These nests are as remarkable for their dimensions as the birds which construct them. These animals evidently belong to the existing period, for the natives of New Zealand have preserved the recollection of them, and name them *Moa*.

It is even possible that the ancients may have represented the Dinornes on their monuments, and that these birds are no other than the gigantic cranes mentioned in the legends of eastern nations. M. Bonomi saw, upon the tomb of an officer of Pharaoh belonging to the fourth dynasty, a bas-relief on which birds of this kind were represented, the dimensions of which were very large*.

No doubt, the disappearance of those species which lived not long since, may appear at first sight very extraordinary, but it is easily explained when we attend to the organization of these animals. The Dodo, for example, which was formed neither for running nor flight, could not escape from our pursuit. The size of the gigantic stag prevented it, in like manner, evading the attacks which were made upon it. The establishment of Europeans in the island of Mauritius has thus been the principal cause of the disappearance of the Dodo, just as the clearing away of the forests which covered the face of ancient Germany has occasioned the loss of one of the most remarkable animals of our world.

Many of the animals figured or sculptured on the monuments of antiquity, and uniting conditions which render their existence possible, have no longer representatives, as is also the case with certain species buried in the ancient catacombs of Egypt. Geoffroy Saint-Hilaire has sought in vain in that country for traces of the two crocodiles which he found embalmed in the Egyptian tombs. These two races, named by him *Crocodilus lacunosus* and *Crocodilus complanatus*, are still to be sought for among the living races.

There is no need, therefore, of extraordinary causes in order to destroy certain species; it is sufficient to bring about this result, that the species cannot escape our pursuits, nor defend themselves against our attacks. It is obvious that they become extinct so much the more speedily if their fecundity be inconsiderable, and the number of deaths exceeds that of

* See Bibl. Univ., vol. lviii., p. 395.

births. The loss of a species may, therefore, depend on the simplest circumstances, and be the effect of causes by no means beyond the ordinary course of things.—See the paper entitled "On the Question—Is there Identity between the Species of the Secondary and Tertiary Formations?" in *Jameson's Journal*, No. 84.

REPRODUCTION OF ANIMALS.

Dr. Allen Thomson has communicated to the Royal Society of Edinburgh, a paper of observations upon the occasional Reproduction of the common green polype of fresh water (*hydra viridis*) by means of fecundated ova; and in particular, upon the existence of spermatic and ovigerous capsules in the same individual. For the details of this paper we must refer the reader to *Jameson's Journal*, No. 84; but quote the following reflections suggested by the inquiries:—

"With many others of the same kind, they point out the multitude of the resources of Nature, and almost lavish expenditure of her care in providing secure means for the continuance of the species of animals. They call our attention to the remarkable fact of the existence of two distinct kinds of generative elements, even among the simplest of animals. They thus add probability to the view deducible from an extended consideration of the recent observations in the vegetable as well as the animal kingdom, that in no instance is a new organized structure, under the form of an ovum, seed, or spore, separated from a parent, and made capable of producing a new being, without the concurrence of generative elements of two kinds—one of these being itself a cell, or in a vesicular form; the other being a peculiar product of cell development, and most frequently assuming the form of minute filaments endowed with a power of rapid vibratile motion. Lastly, in contemplating the alternate production of buds and ova from the same situation in these polypes, they suggest the interesting speculative inquiry whether the concurrence of a male element is necessary to give fecundity to the germ of a mere bud—a view in regard to which, although some circumstances appear to give a show of probability, the want of sufficient observation forces us in the meantime to suspend our judgment."

ANATOMICAL RESEARCHES ON THE BRILLIANCY OF THE EYES IN CERTAIN VERTEBRATA.

M. Brucke, in a preceding Memoir (*Müll. Archiv*, 1844), has endeavoured to discover the use of the *bâtonnets* of the retina. It is known that distant vision results from this, that all the rays of light emanating from a point of space, again converge on a point of the retina. In order to satisfy this condition, it is necessary that the luminous rays which have traversed the expansion of the optic nerve should either be entirely absorbed by the choroid, or rather reflected in such a way as again to strike with precision the nervous fibre they have already traversed. The choroid, by its black colour, is eminently fitted to absorb the luminous rays. This absorbing power is, probably, increased by the inequality of its surface, caused by the presence of transparent *bâtonnets* and their conical prolongations which penetrate between the cells of the pigment.

But, in certain vertebrata, we find a tapetum which, far from absorbing the light, reflects it strongly. In this case, these batonnets, arranged as they are perpendicularly to the surface of the retina, serve perhaps to insulate the rays of light, and to direct them, after their reflection from the tapetum, exactly on the same fibres which they have traversed. We can thus understand why the tapetum does not injure vision, and why the animals whose eyes are provided with it have need of less light than others. The light, in fact, traverses the nervous expansion in animals with a black choroid only once, while it traverses it twice in animals with a tapetum.

The memoir, the little of which has been given above, is a continuation of the first. The author first studies the colour of the reflection from eyes with a tapetum. This colour varies considerably. Seen in the evening by the light of a torch, the reflection in the eyes of a dog passed successively from reddish-brown to fire-red, to blue, green, light yellow, white, and even, in some dogs, to violet. These variations in colour are perhaps owing, in some measure, to the injection of a greater or less quantity of blood into the choroid, but particularly to the changes in adjustment of the animal's eye.

In the Mammifera, the tapetum is a membrane distinct from the choroid. It contains no vessels; it is traversed only by the blood-vessels which unite the two layers of the choroid between which it is found. In Ruminants, Pachyderms, some Marsupials, and Dolphins, the tapetum is fibrous, and composed of undulating fibres, smooth and transparent. But the tapetum of the dog and cat is very different; it is a cellular tissue. It contains no fibres, and is composed of cells more or less hexagonal, and with a transparent nucleus. In the dog the diameter of these cells varies from 0·0008 to 0·0018 of an inch (0·022 to 0·049 millim).

The author has not found this tapetum in the eye of birds or reptiles. In fishes, the tapetum is composed of cells, in which are arranged crystals, which give it a silvery reflection. These cells are elongated and flattened; their largest diameter is four times greater than that of the tapetum of carnivora.

Lastly, M. Brucke gives the comparative anatomy of the tapetum in the different orders of Mammifera and fishes in which he found it.—*Jameson's Journal*, No. 84.

CAUSE OF SEA-SICKNESS.

M. Pellerin has read to the Academy of Sciences, at Paris, a paper on Sea-Sickness. He begins by showing that there is no foundation for the two opinions which attribute this malady either to a congestion of the brain or to a commotion in the abdominal viscera caused by the motion of the vessel. According to him, sea-sickness is to be attributed to the derangement in the circulation of the blood by the alternate rolling and heaving of the vessel. The result of this, he says, is not a congestion of the brain, as stated by Wollaston; but it is, on the contrary, deprived of some of the blood required to keep up a stimulus at this nervous centre. What is felt in sea-sickness resembles what is frequently felt immediately

after a letting of blood when the patient stands or sits, viz.,—a disposition to vomit, or actual vomiting.

FOOD OF THE MASTODON.

Prof. Gray has stated to the Boston Natural History Society, that there had been recently placed in his hands specimens of earthy matter, filled with finely broken fragments of branches of trees, which were said to have been found occupying the place of the stomach in the skeleton of the Mastodon exhumed on Schooley's Mountain, N. I., and lately exhibited in Boston. As similar observations are said to have been made in several instances, Professor Gray was induced to examine the substance brought to him. The wood evidently consisted of branchlets of one, two, and three years old, broken, quite uniformly, into bits of half an inch or so in length, with only now and then traces of the bark remaining on the wood. The wood was not at all fossilized, and was but slightly decayed. From the appearance of the branchlets examined, Professor Gray inferred that they belonged to some coniferous tree or shrub, and probably to a kind of spruce fir, rather than to a true pine. This inference was borne out by the examination of thin slices of the wood by the microscope. The woody fibre was very beautifully and distinctly marked with the circular discs that are characteristic of all coniferous wood. The structure agreed quite perfectly with that in similar branchlets of the common hemlock spruce.—*American Journal of Science*, &c.; *Jameson's Journal*, No. 85.

PACHYDERMATA AND RUMINANTIA.

The Prince of Canino has made to the British Association, some general remarks on the classification of Mammalia; more especially in reference to Prof. Owen's views of the connexion between the Pachydermata and Ruminantia. He was sure he only expressed the feelings of a great many continental naturalists, when he said that he was sorry that Prof. Owen had come to this conclusion; although, if truth compelled him to give up the old order Ruminantia, he would do so. So strong were the characters which connected together this order, that Illiger thought it might even be reduced to a genus.

Prof. Van der Hoeven stated that the peculiar character of the stomach, the general form of the skeleton, the form of the condyles of the jaw, and the nature of the teeth, seemed to connect the Ruminantia so strongly together as to render their fusion with any other order almost impossible.

Prof. Owen remarked, that if we confined our attention to existing forms of animals, we might arrive at the conclusion of Prof. Van der Hoeven; but it was when we studied extinct forms that we saw our ground giving way. He then pointed out the fact, that in the Camelidæ and Moschidæ there was a departure from the normal type of the stomach in Ruminantia, approaching, in fact, the character of that of the Pecora. Although the number and character of the teeth in the adult forms of Ruminantia differed from those of the *Pachydermata*, yet, when we examined the young of many of the Ruminantia, we found there a departure from the adult type, and an approach to that of Pachydermata. Again,

Cuvier had placed the fossil genus Anoplotherium amongst Pachydermata on account of its divided or double cannon bone; but even this character had been observed by Dr. Falconer in the Ruminantia in a species of Moschus.

OSTEOGRAPHY OF THE RHINOCEROS.

M. DE BLAINVILLE has published the twentieth part of his great work on the Osteography of the Vertebratæ; or, an Iconographic Description of the Skeleton and Dental System of the Five Classes of Vertebrate Animals. This number contains the Natural History of Rhinoceroses.

These animals form so distinct a genus, that we rarely find errors in the generic determination of their fossil bones; but the case is not the same with regard to the discrimination of species. If we adopt as real all that have been indicated, we must believe that, during the conclusion of the tertiary epoch and the commencement of the diluvian epoch, at least eighteen species of de Rhinoceros inhabited Europe! Extensive researches continued during three years, and the comparison of a great quantity of bones, have convinced M. de Blainville that the number must be greatly restricted, and that the greater part of these species had been established without sufficient grounds. We shall not attempt to give in this place an extract of the numerous anatomical and odontographic details contained in this voluminous memoir; we shall merely point out the principal conclusion to which the learned author has come with regard to the number of species, and their geographical and geological distribution.

M. de Blainville admits five living species as indisputable; two of which are African—the rhinoceros of the Cape (*Rh. bicornis*), and the camus rhinoceros of Southern Africa (*Rh. simus*); three are Asiatic—the rhinoceros of India (*Rh. unicornis*), the rhinoceros of Java, with one horn and $\frac{0}{2}$ incisors (*Rh. Javanus*), and that of Sumatra, with two horns and probably $\frac{0}{2}$ incisors (*Rh. Sumatranus*). Some authors distinguish two other African species, which M. de Blainville considers imperfectly characterized. Some accounts would likewise lead us to believe in the existence of a rhinoceros in Africa with one horn, which would form another species to be added to the preceding.

Among the fossil rhinoceroses, M. de Blainville admits but three European species as certain. The first is the rhinoceros with partitioned nostrils (*Rh. tichorhinus*). This species, destitute of incisors, had three toes on each foot, the cranium elongated, the nostrils separated by a bony partition; its nose was provided with two horns; its molars approached those of the Rhinoceros camus, its bones were short and strong, and its body covered with hair. M. de Blainville remarks on this subject, that these hairs have sometimes been erroneously described as forming a long and thick fur, but at most they did not exceed three lines in length. *Rh. tichorhinus* is found in the deposits formed during the diluvian epoch. It is probable that it inhabited Siberia, and the greater part of Europe. This is the species which has been found preserved in the ice of the North of Asia.

The second species is the rhinoceros with nostrils not partitioned (*Rh.*

leptorhinus), which had persistent incisors, but concealed in the gums, three toes on each foot, two horns, an elongated cranium, and slender bones. We must unite with it the *Rh. Monspesullanus* of M. de Serres, and *megarhinus* of Christol. This species, which is not so well characterised as the preceding, has been found chiefly in the superior tertiaries of Italy and the South of France. M. de Blainville likewise refers the bones found in caverns in the South of France to *Rh. tichorhinus*, while those of the North and of Belgium contain only the remains of the preceding species.

The third species is the rhinoceros with incisors (*Rh. incisivus*), characterised by ½ salient incisors in the two jaws, four toes on the anterior feet, flat metatarsi, &c. It would appear that the male bore two horns, and that the female was destitute of these appendages. The latter, for this reason, has been made the type of the genus *Acerotherium* of M. Kaup. The *Rh. incisivus* is found in the middle tertiary formations, and has been described under many names. It will probably be found necessary to refer to it all the species found at Eppelsheim, such as the *R. Goldfussii, Schleyermacheri, Merckii*, &c., all those found at Sansans, those of Avaray, of Moissac, and Auvergne, described under the names of *elatus*, &c., the *R. minutus* of Cuvier, found in the *faluns*, &c.

With regard to the fossil species found out of Europe, M. de Blainville mentions a rhinoceros discovered in the tertiaries of India, and which, perhaps, does not differ from *R. unicornis*. The pretended rhinoceros of the Alleghanys has been described from a body which is altogether artificial, and is a gross imposition.

In short, rhinoceroses have not existed during the whole commencement of the tertiary epoch, for the eocene formations yield no trace of them. They have appeared, for the first time, in the middle or miocene period, during which the *R. incisivus* has inhabited the greater part of Europe. Towards the close of the tertiary epoch this species has been replaced by the *Rh. leptorhinus*, and during the diluvian epoch, it is the *Rh. tichorhinus* which has been the most abundant and most widely diffused. In the present day, rhinoceroses do not exist in Europe, and are only found in the warmest countries. We find two (perhaps three) species in Africa, one species in Continental Asia, and two in the Sunda Islands. America and New Holland have not any at present, and do not appear to have possessed any in the epoch anterior to our own.

With respect to the zoological relations of the species, we may form them into three groups. The first will contain the *Rh. bicornis* and *simus*, among the living species, and *tichorhinus* and *leptorhinus* among the fossil; the second, the living rhinoceroses of Asia; and the third, the fossil *Rh. incisivus*.—*Supplement à la Biblioth. Univer. de Genève; Jameson's Journal*, No. 84.

THE AUROCHS,

Presented to the Zoological Society by the Emperor of Russia.

THE existence of the Aurochs, Zubr, or European Bison, which once roamed over all the woodland districts of central Europe, and which in our own island was contemporary with the extinct races of Mastodon,

Elephant, and Rhinoceros, is now confined to the forest of Bialowicza, in the government of Grodno. In this last asylum, it is carefully protected by the Imperial Government, whose stringent enactments alone have saved it from extirpation. To our scientific readers it will be scarcely necessary to advert to the peculiar interest which attaches to this animal. To those who are desirous of information as to its former place in the Fauna of this country, we recommend a perusal of Professor Owen's "History of British Fossil Mammals," pp. 491-497. Its nearest ally in the existing animal kingdom is the American Bison, of which there are two fine adult examples in the collection of the Zoological Society; but from this it differs in several very marked peculiarities.

When we consider the wide diffusion of that love of Natural History which originated among Englishmen in the works of Ray, and was fostered by Gilbert White and his successors, we are scarcely too sanguine in believing that this unique gift of His Imperial Majesty will not fail to be appreciated as generally as it deserves. We are informed, on good authority, that, with the exception of one instance, which occurred about three hundred years ago, these are the first individuals of this species which have ever lived in captivity; and the experiment which has succeeded so admirably was only attempted by M. Dolmatoff, the master of the forests in Grodno, in consequence of His Imperial Majesty's desire to mark his approbation of what he saw in the establishment of the Zoological Society, during his brief stay in London in 1845.

It only remains for us to add, that the young male and female above mentioned were captured in the summer of 1846, and are now about 18 months old. They were transmitted to Memel in charge of one of the Imperial under-foresters, and delivered there to a keeper on the Society's establishment, who was dispatched to meet them in August last. On being liberated from their long confinement, they exhibited a degree of activity which reminded more than one of the spectators of the action of the Gnu, a singularly bovine form of antelope, of which an unique specimen once graced the Society's menagerie.

The extent of the Garden in which the Society's collection is placed prevents the casual visitor from forming an accurate estimate of its riches. We were surprised to learn that, in the Parrot-house alone there are upwards of sixty species of that exotic family, besides several rarities kept there for convenience which belong to other groups. The total number of animals considerably exceeds 1100, and affords the most complete aid to the study of General Mammology and Ornithology, which, perhaps, was ever collected together at one view.—*Illustrated London News*, No. 285.

THE CAPRA PUDU AND EQUUS BISULCUS OF MOLINA.

Molina, in his essay on the Natural History of Chili, has referred to the genus of goats, and describes, under the name of *Capra pudu*, a small ruminant which systematic authors have had difficulty in referring to its true genus. This animal, named *Venado* by the Spaniards, has successively been regarded as a goat, a sheep, and an antelope. MM. Gay and Gervais shew in this article that it is a small stag allied to the *Cervus*

rufus and *nemorivagus*, and that it is probably the same species as the female which lived in the Zoological Gardens of London, and which has been described by Bennett under the name of *Cervus humilis*.

The same work of Molina contains some details respecting an animal which this author names the *Gemul* or *Equus bisculus*. His description shews that he has no reason for referring it to the horse tribe, and the mammifer indicated by this name is, like the preceding, a true stag, but of much larger size. It approaches the *Cervus antisiensis* found by M. D'Orbigny in the Bolivian Andes, and it appears to form a new species, which the authors of this memoir name *Cervus Chiliensis*. These same naturalists are of opinion that it is necessary to add two others, the *Cervus Spinosus* and *C. Goudotti*, to the list of species now known in South America. M. Gay will describe their characters in the mammalogical part of the History of Chili, which is publishing in the Spanish language. —*MM. Gay and P. Gervais*; *Ann. des Sci. Nat.*

BREEDING OTTERS.

THERE have been read to the Zoological Society, the following notes on the Breeding of Otters, in the Society's Magazine, by J. Hunt, head-keeper. Two young otters were first observed on the 13th of August, 1846, when apparently five or six days old, and about the size of a full-grown rat. The mother was noticed to move them, when about sixteen days old, from their den to another, which had been supplied with fresh straw, at the opposite end of the inclosure. This operation, which was repeated whenever their bed required renewal, she accomplished by pushing them before her on a little straw. On the 26th of September they followed their mother into the water; swimming, like dogs, with their heads above the surface. On the 22nd December, the young ones got into the pond when but half filled with water, and were unable to climb out up the perpendicular sides. When they had remained in the water some minutes, the mother seemed anxious to get them out; and made several vain attempts to reach them from the side of the pond. She then plunged into the water; and after playing with one of them for a short time she put her head close to its ear, as if to make it understand her intention, and then sprang out of the pond, while the young one clung tightly by its teeth to the fur at the root of her tail. Having landed it, she rescued the other in the same manner.—*Athenæum*, No. 1014.

NEW CETACEA.

MR. J. E GRAY has described to the British Association, two new species of Cetacea. The author stated that our present knowledge of the Cetacea was imperfect; as few points of generic or specific value had been noted in the descriptions and drawings of the various whales that had been found in different parts. He believed that a greater number of species would be found to exist, were this point inquired into. Even with regard to the whale that furnished whalebone, those artizans who worked in it knew that the whalebone from Greenland was a much better article than that from the Cape or from the south seas; and yet, no distinction existed among naturalists, as to the species which produced this whalebone. He

believed, from a comparison of the structure of the vertebræ of the whale now in the Ashmolean Museum with one in the British Museum, that a specific difference existed, although they were thought to belong to the same species. He concluded by describing as two distinct species two whales which had been originally separated by Sibbald, but afterwards united by Cuvier, under the names of *Balænophoca Sibbaldii*, and *B. antiquorum*.

In answer to a question from Mr. Duncan, Mr. Gray stated that he could identify five species of British Cetacea, besides those described—*Balæna enystacetus*, *Physeter Boops*, *P. musculus*, and *Megapteryx longimana*. The Prince of Canino objected to the use made by Mr. Gray of old names applied to new species, as likely to mislead. It would be better to leave the old names unused than to apply them to new species. Mr. Gray stated that many species of whales might be known by the parasites which inhabited their bodies. He believed it impossible for the whales of the south seas to cross to the north seas. The Rev. Dr. Scoresby stated that the distribution of whales was determined by their food. Whales travelled slowly—at quickest, certainly, not more than six or eight miles an hour. The young differed in appearance from the old ones, which might account for the want of an accurate knowledge of their external characters.

THE JOHN-CROW VULTURE.

From a Memoir of this Vulture, (*Turkey buzzard*, Wilson; *Cathartes Aura*, *Vultur Aura*, Linn.; *Cathartes Aura*, Illiger,) by R. Hill, Esq., of Spanish Town, we gather that the common opinion is erroneous, which attributes to this bird a confinement of appetite to flesh in a state of decomposition. Flesh is his food, and that he does not pounce upon living prey, like the falcons, is because his structure is not adapted for predatory warfare, and not because he refuses recent and even living flesh, when in his power. If the John-Crow vulture discover a weakling new-born pig apart from the rest, he will descend, and seizing it with his beak will endeavour to drag it away: its cries may bring the mother, but before she can come, the vulture gives it a severe nip across the back, which soon ensures the pig for his own maw. If a large hog be lying in a sick condition beneath a tree, the vulture will not hesitate to pick out its eyes, having first muted upon the body, that it may discover whether the animal be able to rise; the contact of the hot fæces arousing the hog if he be not too far gone. Cattle also he will attack under similar circumstances. One of Mr. Hill's servants once saw a living dog partly devoured by one. The dogs of the negroes, half-starved at home, "bony, and gaunt, and grim," if they discover carrion, will gorge themselves until they can hardly stir, when they lie down and sleep with death-like intensity. A large dog thus gorged was sleeping under a tree, when a John-Crow descended upon him, perhaps attracted by the smell of the carrion which the dog had been devouring, and began tearing the muscles of the thigh; it actually laid open a considerable space before the poor animal was aroused by the pain, and started up with a howl of agony. The wound was

dressed, but the dog soon died.—*The Birds of Jamaica, by Philip Henry Gorse.*

HUMMING BIRDS.

THERE have been described to the Zoological Society, the "characters of fifteen unpublished species of Trochilidæ in the collection of the late Mr. Loddiges, from his MS. notes, described by M. Bourcier." M. Bourcier having visited this country for the purpose of completing his acquaintance with the Humming Birds, upon which he is preparing a monograph, has received permission from Mr. Conrad Loddiges to lay before the Society an account of the species which still remain unique or unpublished in this superb collection. *Trochilus mirabilis*, Lodd., is without doubt the most remarkable member of this family yet discovered. It has been in Mr. Loddiges' possession since 1836, and no second example has reached Europe. It was obtained in a deep gorge of the Peruvian Andes, and is the gem of the collection. Of the fourteen other species, *Tr. Aquila* presents perhaps the most interesting form. We can only give the names of *T. Millerii. T. Schreibersii, T. Matthewsii, T. Watertoni*, Lodd., *T. Evelynæ, T. Johannæ, T. Conradii, T. Yarrellii, T. Spencei, T. Ruckerii, T. Doubledayi, T. Mitchellii, T. Norrisii*, Bourc. *T. Caroli, T. Georginæ*, are new species from the collection of Mr. Wilson and the author. M. Bourcier remarked that he had found in this country in the collections of Mr. Loddiges, Mr. Gould, Mr. Rucker, and Mr. Leadbeater, thirty species which are not in France.—*Literary Gazette*, No. 1570.

NEW DUCK.

THERE has been read to the Zoological Society, the "description of a new species of Duck (*Fuligula ferinoides*)," by Mr. A. D. Bartlett. Three examples having passed through the hands of Mr. Bartlett, which appeared to resemble each other too closely to admit of their being hybrids, as was supposed of the first which occurred, the author was induced to examine all the species of this genus which are known to inhabit Europe and America. The result has been his conviction that the birds exhibited are not only new to Britain, but have hitherto escaped the knowledge of naturalists altogether. The capture of a female will complete the evidence ingeniously adduced by Mr. Bartlett; and his discovery will be a subject of interest to the students of British and northern ornithology, to whom a new species is now a thing scarcely to be hoped for.

USE OF GUANO IN PERU*.

DR. TSCHUDI, in his valuable *Travels in Peru*, says:—Much has recently been written on the employment and utility of Guano; but the manner in which it is employed as manure in Peru, seems to be little known.

* Travels in Peru. By J. J. Von Tschudi, well translated from the German by Thomasina Ross: published by Bogue, 86, Fleet Street. Dr. Tschudi notes the original name of Guano is Huanu, which is a term in the Quichua dialect, meaning "animal dung"; for example, *Huanacuhuanu* (excrement of the Huanacu). As the word is now generally used, it is an abbreviation of *Pishu Huanu*, bird-dung. The Spaniards have converted the final syllable *nu* into *no*, as they do in all the words adopted from the Quichua which have the like

The Peruvians use it chiefly in the cultivation of maize and potatoes; a few weeks after the seeds begin to shoot, a little hollow is dug round each root, and is filled up with guano, which is afterwards covered with a layer of earth. After the lapse of twelve or fifteen hours, the whole field is laid under water, and is left in that state for some hours. Of the *Guano blanco* a less quantity suffices, and the field must be more speedily and abundantly watered, otherwise the roots would be destroyed. The effect of this manure is incredibly rapid. In a few days, the growth of the plant is doubled; if the manure be repeated a second time, but in smaller quantity, a rich harvest is certain;—at least, the produce will be threefold that which would have been obtained from the unmanured soil.

The haciendas of the valley of Chancay have during the last fifty years consumed annually 33,000 to 36,000 bushels of guano, brought from the islands of Chanchacca and Pisco.

The price of the bushel of coloured guano is one dollar and a quarter, and the price of the white from two to three dollars. The price has recently undergone many fluctuations, in consequence of the great exports to Europe.

The employment of this kind of manure is very ancient in Peru; and there is authentic evidence of its having been used in the time of the Incas. The white guano was then chiefly found on the islands opposite Chincha; so that for upwards of six hundred years the deposit has been progressively removed from those islands without any apparent decrease of the accumulation. The uniformity of climate on a coast where there is not much rain, must contribute to render the Peruvian guano a more arid manure than the African, as fewer of the saline particles of the former being in solution, they are consequently less subject to evaporation.

IMPEYAN PHEASANTS.

Two fine specimens, a male and a female, of that rare and beautiful bird, the Impeyan Pheasant (*Lophophorus Impeyanus*), stated to be the only living examples ever seen in Europe, have been brought from India by Captain Watts, of the Bengal Cavalry, and are now in the collection of the Earl of Derby, at Knowsley.

The Impeyan Pheasant is a native of the Himmalaya Mountains, and is never found in the plains. Its size is double that of the well-known pheasant of the British Isles. In the male, the head and throat glisten with metallic green; the feathers of the lower part of the neck and top of the back are lancet-shaped, and of an intense metallic purple; the wings and general plumage are steel-blue, with a white band across the lower part of the back; the tail is rufous brown. The female is smaller

termination. The European orthography, *Guano*, which is also followed in Spanish America, is quite erroneous, for the Quichua language is deficient in the letter *G*, as it is in several other consonants. The *H* in the commencement of the word is strongly aspirated, whence the error in the orthography of the Spaniards, who have sadly corrupted the language of the Antochthones of Peru.

For several contributions to the Natural History and Commercial Economy of Guano, see Year-book of Facts, 1845, 1846, and 1847.

than the male, and differs greatly in colour, being of a dull brown, and having a white throat. The male has a most beautiful crest, formed of long slender shafts, spreading into a spatulate form at the extremities. In the female, the crest is very trifling. These pheasants derive their European cognomen from Sir Elijah Impey, the first English naturalist by whom they were noticed.—*Illustrated London News*, No. 270.

THE GREAT BUSTARDS IN THE GARDENS OF THE ZOOLOGICAL SOCIETY.*

The last abodes of the Great Bustard in England were Salisbury Plain, the Yorkshire Wolds, and the open country about Newmarket. In all these localities it is now, however, extinct; its large size and wandering habits having rendered abortive all the efforts of the landowners for its protection. Two birds of the past year have been obtained from Central Germany, where they are still found in considerable numbers. The plains of Spain, Italy, and the Levant, are also reported to produce a certain number of this species, which, although rapidly decreasing, has a very extensive geographical distribution. In India, Australia, and Africa, the Great Bustard is represented by kindred forms—of which, however, none exceeds it in beauty of colour or majesty of carriage.

The males, when perfectly adult, are adorned with a fan-like tuft of long slender feathers, which grow downwards and backwards from the chin; they not unfrequently attain a total length of forty-five inches, although the females are nearly one-fourth less in all their dimensions. The anatomical structure presents some striking peculiarities, which will be found in detail, with many other interesting particulars, in Mr. Yarrell's excellent "History of British Birds."

The last recorded instance of a Bustard in England was in the Spring of 1844. A solitary female was killed near Bonython, in Cornwall, in a turnip-field, which it had frequented for some days previously; the country people devoutly believing it to be an eagle, in consequence of its great size and the noise with which it rose from its covert. We believe that this specimen is now in the fine collection of British Birds which has been formed in that county by E. H. Rodd, Esq., of Penzance.

THE DODO.

As the British Association held their late meeting at Oxford, (where is preserved one of the only two heads of the Dodo known), opportunity was taken to present to the Zoological section some elucidation of the

* On June 26, 1847, the Society lost one of the attractions of their Menagerie—the Great Elephant. He was purchased by the Society, in 1831, from Capt. Smith, who brought him from the East Indies. The Elephant was then supposed to be twenty-four years of age, so that he was, probably, about forty at his death. He had long suffered from an affection in the left knee, so that he could not take exercise, the want of which, with his vast weight, soon brought about his death. When it happened, he sunk from his usual posture, on the ground; in two hours, his trunk relaxed, and sank to the ground; his eyes closed—and he died. There was no movement, not a shudder, or sigh; his head did not fall; he lay upright, and nothing death-like, but the perfect stillness and repose.—See a portrait of this Elephant, in No. 268 of the *Illustrated London News*.

structural economy and classification of the extinct bird. Thus, Mr. H. E. Strickland pointed out the various characters, external and internal, which prove the Dodo to be an aberrant genus of the family *Columbidæ*, and to have no connexion whatever with the Vultures. His arguments were chiefly drawn from the form of the beak, the position of the nostrils, the form of the palatine bones, of the nasal fissures, and of the zygomatic bones, the muscular gizzard, the shape of the feet, the structure of the calcaneal processes, and of the posterior metatarsal,—all which closely agree with the Pigeons, and especially with the genus *Treron*.

Dr. Melville, who has lately made a minute examination of the head and foot of the Dodo, drew attention to some additional characters, which confirmed Mr. Strickland's view of the affinities of that bird to the pigeons. The Prince of Canino stated, that he was convinced that the Dodo was neither a vulture nor an ostrich; but he must differ from his friend, Mr. Strickland, in placing it amongst the Pigeons. He believed it was as much like the Gallinaceæ. The stones found in its gizzard did not prove it a pigeon. The sternum resembled more that of gallinaceous birds, or even the struthious, than that of the pigeons. Dr. Melville maintained that the sternum of Dodo more nearly resembled those of the pigeons than of any other family. The skin of the Dodo proved that it was a pigeon.—Mr. Philip Duncan stated, that the notices of the habits of the Dodo were quite opposed to the notion that it was a pigeon. It was evidently not a frugivorous bird, as when first taken its flesh was so distasteful, and smelt so badly, that no one would attempt to eat it. He believed it a bird *sui generis*.

At one of the evening meetings of the Association, at the Radcliffe Library, a lecture was delivered by Mr. Strickland, "On the History of the Dodo and other Allied Species of Birds." He showed from historical data that each of the three islands of the Indo-African Ocean (Mauritius, Rodriguez, and Bourbon,) was originally inhabited by peculiar species of brevipennate birds, all of which were speedily destroyed by the early colonists. Mauritius was the birth-place of the Dodo: the first notice of which was not, as erroneously stated, by Vasco de Gama, (who never visited Mauritius), but by Van Neck, a Dutchman, in 1598. Several successive voyagers mention the bird, down to Cauche in 1838; and in the latter year a live specimen was brought to London, and was described by Sir Hamon Lestrange. The *pictorial evidence* respecting the Dodo consists of four oil paintings: one in the British Museum, without the artist's name; one at the Hague, and another at Berlin, by Roland Savery; and one at Oxford, by John Savery, his nephew. All these are evidently from one design, and may have been drawn from a specimen which Van Neck brought to Holland. The *osteological evidences* of the Dodo consist of the foot in the British Museum, the head and foot at Oxford, and a head lately discovered at Copenhagen. The three former specimens were exhibited: and a cast of the latter had also been sent for the meeting, but was detained by the vexatious formalities of the London Custom-house. The Oxford head and foot have been recently dissected; and from the characters thus exposed, it is certain that the Dodo was not related either to the gallinaceous birds, the ostriches, or the vultures, as

others have conjectured; but is closely allied to the pigeons. With the exception of its short wings, it approaches greatly to the *Trerons*, or fruit-pigeons; and still more to the *Didunculus*, a kind of pigeon from the Samoan Islands, of which the only specimen in Europe was exhibited at the meeting. The author supposed that the Dodo fed upon the cocoa-nuts, mangos, and other fruits which in tropical forests fall from the trees at all seasons of the year. The lecturer then drew attention to the island of Rodriguez, visited in 1691 by Leguat; who has given a description and figure of a brevipennate bird, which he calls the *Solitaire*. Several bones of this bird, from the Museums of Paris and of Glasgow, were on the table; and a comparison of them with those of the Dodo clearly proved that the Solitaire was an allied, but distinct, species,—longer legged than the Dodo, and related, like it, to the pigeons. It was next shown, from the narratives of several voyagers, that the island of Bourbon was also formerly inhabited by two species of short-winged birds, of the same abnormal group as the Dodo and the Solitaire. Unfortunately, we have as yet no osseous remains of these birds from Bourbon: but they might doubtless be procured from the caves and alluvial deposits of that island; and by similar researches in the Mauritius and Rodriguez, the entire skeletons of this remarkable family of extinct birds might be reconstructed.—*Athenæum*, No. 1029.

In *L'Institut*, No. 709, we find the following interesting *précis*:—M. Hamel has a cast of the head of the Dodo preserved in the Museum of Natural History at Copenhagen, (alluded to by Mr. Strickland,) the only other one now known, although it wants the lower mandible.

M. Hamel says: "A comparison of the heads of Oxford and Copenhagen shows, that although the former be much stronger than the latter, they both agree in their various details. The Oxford head is still covered with skin, having been cut without care in 1755, and dried; while that of Copenhagen is a preparation of the bony parts, and consequently presents the structure of the bones, which is invisible in the Oxford specimen. We do not observe in the Copenhagen specimen the characteristic broadness of forehead, and the angle of about 140 degrees which it forms with the beak, nor the immoderately large diameter of the whole cranium, which are so striking in the Oxford example. The latter measures from the occiput to the extremity of the beak (the gnathotheca excepted, which is nearly wanting in both) $8\frac{6}{10}$ English inches, and that of Copenhagen $8\frac{1}{10}$ inches. The greatest diameter of the Oxford specimen, including the skin which covers it, is $3\frac{9}{10}$ inches; and in the other, which is without skin, $3\frac{5}{10}$ inches.

"The foot of the Dodo, in the British Museum, is supposed to be the same that Clusius observed before 1605 in the collection of Professor Pauw, at Leyden, as coming from the Island of Mauritius. As it had been announced that a living Dodo was embarked in 1598 by the Dutch, and as Clusius, in 1605, was unable to prove that an animal had been brought into the country alive, it is inferred that the bird embarked at the Mauritius in 1598 died on its way to Holland, and that it was from it the foot in Pauw's possession was obtained. The report of a Dodo

having been transported from the Mauritius to Holland has been alluded to only by De Brys, and it cannot therefore be considered as altogether authentic.

"The foot preserved at Oxford, and which, as well as the head of the Dodo, is from the Tradescant Museum, has been stripped of its skin by Dr. Kidd, in such a manner that the bones, ligaments, and nerves, can now be studied.

"In the Ashmolean Museum at Oxford, there is a large drawing of a Dodo, taken from nature, for which we are indebted to John Savery. Little attention has been hitherto paid to this. This figure is particularly important on account of the feathers, wings, and tail; for the head and feet do not appear to be accurately designed. Below it there are a frog and a few cryptogamous plants, which seem to be in allusion to its kind of food.

"John Savery may have had an opportunity in 1651 of seeing a living Dodo, or, at least, a sketch made from nature, and by means of which he completed his figure. By a manuscript notice preserved in the British Museum, and which was obtained from L'Estrange, we learn with certainty that in the year 1638, a living Dodo was exhibited for money in London, in a house before which a figure of the bird was represented on canvas. Again, a stuffed specimen is mentioned in 1651, in the catalogue of Tradescant's collection, printed in 1656, but drawn up some years before, in 1652, by Drs. Wharton and Ashmole. In this catalogue we find, at page 4, the Dodo indicated under the name of Dodar (which ought to have been Dodo-aers). It is from this specimen, conveyed in 1682 by Ashmole to Oxford, where it was destroyed by vermin, and consequently lost in 1755, that the foot and head so fortunately preserved have been obtained. It may be presumed that the Dodo which was exhibited alive in London, in 1638, had been obtained after its death by the second Tradescant for the museum of his father, who died in 1638; so that the existing head and foot in the Ashmolean Museum, are the same as those which L'Estrange saw in the living bird in London.

"The figure of the Dodo, so often cited and copied, and taken from Sloane's drawings in the British Museum, (not made by Edwards, as Mr. Owen affirms,) does not appear to me to be taken from nature. Besides the Dodo, we there find parroquets also, and other birds or animals. Neither date nor artist are mentioned, and I consequently consider them as without value. But, on the other hand, I thought it proper to have an exact and coloured copy of a small picture (five inches in height at the most) in the Royal Museum at the Hague, representing a Dodo, which is to be seen among the well known pictures of Roland Savery, who died in 1639, which represents Orpheus charming animals. Roland Savery was the uncle of John Savery mentioned above. There are two other similar pictures by him, as well as others filled with animals (the Terrestrial Paradise, *Sortie de l'Arche*, &c.) which are worthy of being examined by zoologists. The living Dodo, shown in London in 1638, had very likely been conveyed to Holland, and if this individual had been observed before by R. Savery, and if it be the same that passed into the Tradescant Museum after its death, we have, from the hand of this skilful

animal-painter, the general aspect, colour, &c. of the Dodo; while the head and the osseous structure, and the nerves of the feet, are seen in the Oxford specimen, of which I have brought casts, drawings, and photographic representations."

M. Hamel is about to have a model of a Dodo executed, to be painted according to R. Savery's picture.—*Translated in Jameson's Journal*, No. 86.

FOOD OF FOWLS.

A LETTER has been received by the Academy of Sciences, at Paris, from M. Sace, of Neufchâtel, in Switzerland, giving an account of some experiments in the Feeding of domestic Fowls. He states, first, that fowls to which a portion of chalk is given with their food lay eggs, the shells of which are remarkable for their whiteness. By substituting for chalk a calcareous earth, rich in oxide of iron, the shells become of an orange-red colour. Secondly, he informs us that some hens fed upon barley alone would not lay well, and that they tore off each other's feathers. He then mixed with the barley some feathers chopped up, which they ate eagerly, and digested freely. By adding milk to the food they began to lay, and ceased plucking out each other's feathers. He concludes that this proceeding arose from the desire of the hens for azoted food.

NEW APTERYX.

MR. GOULD has described to the Zoological Society, a new species of *Apteryx*, which he named *A. Owenii*—a just tribute of respect to Prof. Owen, whose labours have so thoroughly elucidated the physiology of this form and its allies. The skin, which was exhibited to the meeting, was obtained by way of Sydney, but unfortunately without any information as to the circumstances of its capture. Mr. Gould conjectures, with reason, that its habitat will be found in the middle island of New Zealand. It is clearly distinct from *A. Australi*, which it resembles in size, and still more from the larger one still uncaptured, of whose existence an indication was given at the meeting of April 13th in Mr. Strange's letter. The wing in *A. Owenii* is still more rudimental than in the old species. The plumage is barred instead of streaked, and more hair-like in texture. The discovery of this bird is, certainly, the most important accession to ornithological science which has occurred for a long period.

Mr. Wilson has exhibited to the Zoological Society, an Egg from New Zealand, which was represented by the collector as being that of the Kirvi, or Apteryx, from the Waikato country; but which, if of that genus, will probably prove to belong to the larger species, of which specimens have not yet reached Europe.

APOCRYPHAL ANIMAL OF NEW SOUTH WALES.

IN the *Athenæum*, No. 1030, appears a letter, addressed to that journal, from Sydney, in which the writer states that during a recent trip on the banks of the Lachlan and Murrumbidge, and through the Murray district, he collected many details in reference to this apocryphal animal. The Murrumbidgee blacks assert that a large animal, "*big as him*

bullock," exists in the lakes of that district. They describe it as having a head and long neck like an emu, with a thick mane of hair from the top of the head to the shoulders; as being four-legged, with three toes on each foot, which is webbed; and having a tail like a horse. They call it the *Katenpai;* whilst by the Watta Watta tribe (who similarly describe it) it is called *Kyenprate*,—by the Yabala Yabala tribe, on the Edward River, it is known as the *Tunetbah*,—and the Burrula Burrula tribe call it *Dongus*. The blacks on the Great Carangamite Lake, in the Portland district, describe a similar animal, which they call the *Bunyip;* and various accounts are given from white men (shepherds and others) who profess to have seen the animal at its gambols in the water. Mr. Fletcher, who resided on the Lower Murrumbidgee, was told by a tribe of blacks that they had some time previously killed a *Katenpai* on the banks of a lake near the Murrumbidgee. It must be observed that the blacks have a great dread of the animal, and avoid bathing or fishing in the waters where they assert that it exists. They assured Mr. Fletcher that the remains of the creature would be found on the spot where they had killed it: and, although doubtful of the fact, that gentleman proceeded to the place minutely described by the blacks, and there found a large portion of the skull of some animal, which, to all appearance, had not been dead for any great length of time. No traces of any more bones or other remains could be discovered; but enough was found to prove the existence of the supposed fabulous *Katenpai*. There are no incisors on the portion of the jaw which remains, but three strong grinders are placed on each side, resembling those of the ox, and nearly as large. The blacks assert that it has enormous tusks; but they are wanting in the portion of the skull represented. Scientific examination will most probably determine whether they did exist. The summit of the head, whence the mane flows, is also incomplete. Much of the integuments was still remaining, and traces of blood were visible in several places; the skull is extremely thin near the top, increasing in thickness towards the jaws.

Some bones of the anterior and posterior extremities of a large animal of the mammalia class were sent to Maitland some time since, with a view to their being placed in the Mechanics' Institute. "Are we to identify the *katenpai* or *bunyip* of the westward with the *debbil-debbil* of the piscatory tribes of the coast country, whose obscure references to this object of their dread have so long puzzled us?"—was a question which suggested itself to the writer, whilst listening to the earnest accounts of the Murrumbidgee blacks: and it is on every account to be desired that those of our bushmen who may discover any further traces of this animal will take means of placing them in the possession of witnesses regularly trained in anatomical knowledge,—and thereby complete another page in the history of the animal kingdom of Australia.

DISCOVERY OF THE EGGS OF THE MOA OR DINORNIS OF NEW ZEALAND.

An interesting discovery has been made by Mr. Walter Mantell, of Wellington, New Zealand. In an exploring tour in search of the remains of the colossal ostrich-like birds which once inhabited New Zealand,

and whose bones occur in the alluvial sand and silt of the rivers, Mr. Mantell discovered imbedded with the bones, fragments of their Eggs. The specimens which he has transmitted to his father, Dr. Mantell, are portions of very large eggs, which, in their general aspect, resemble those of the ostrich, but differ in their markings, and relative thickness and size. The edges of these fragments are for the most part water-worn; the external surface is marked by short, interrupted, irregular linear grooves variously disposed in different specimens, probably indicative of specific distinctions. They are altogether unlike the small circular pits on the shell of the ostrich. From the small degree of convexity, even of the largest fragments, it is obvious that they belonged to eggs of considerable magnitude. The bones collected by Mr. Walter Mantell (amounting to 700 or 800), are portions of several skulls and mandibles. The latter will be an important addition to our knowledge of the nature and affinities of the original; for no vestiges of that part of the skeleton have previously been obtained. Although the state of preservation of the bones and the egg-shells proves that they are not, geologically speaking, of great antiquity, and renders it probable that the last of their race may have existed contemporaneously with the human race, yet Mr. Mantell could obtain no trustworthy evidence to warrant the conclusion that any living Moa had been seen by the present inhabitants or their immediate progenitors.—*Literary Gazette*, No. 1039. (See Professor Owen's Memoir on the Dinornis, in the *Year-book of Facts*, 1844, p. 133; and *Year-book*, 1845, p. 248. Also, *Year-book*, 1846, p. 259.)

The lower end of the left tibia of a gigantic fossil Struthious Bird, from the Sewalik Hills, has been exhibited to the Zoological Society. This remain affords another evidence of the close representation of forms between the extinct Fauna of India and the existing Fauna of Africa, which Dr. Falconer's researches have so copiously demonstrated in the genera Camelopardalis, Camelus, Elephas, Hippopotamus, &c. In the discussion which followed, it was remarked by Mr. Gray that this fossilized remain was probably the earliest evidence on record of a bird of so large a size having occurred in juxtaposition with Mastodon, Colossochelys, and others of that age.

CHILIAN BIRDS' EGGS.

Mr. Yarrell has communicated to the Zoological Society, descriptions of a collection of Chilian Birds' Eggs, transmitted to this country by Mr. Bridges, and containing the eggs, now for the first time made known, of nearly thirty species. Mr. Yarrell remarked, that he had been induced to consider the egg of a bird as one stage of condition in the life of the animal; that the eggs of congeneric species, in whatever geographical locality found, will resemble each other in colour and markings, and thus afford indications which may assist in classification. Mr. Gould stated, that his experience in Australia, and acquaintance with the eggs of three hundred species, obtained by his collectors in that country, led him to coincide with Mr. Yarrell's view.

THE NEST OF STICKLEBACKS.

M. Coste has collected some very curious facts "On the manner in which Sticklebacks (*Cottoid fishes*) construct their Nest, and take care of their eggs," which observations have been favourably reported on by Mr. Dumeril. After detailing the structure of the nest, M. Coste states:—"When the male succeeds, by his assiduous care and courageous perseverance, in preserving his nest till near the time of hatching, his zeal is redoubled; he takes away the stones to give more easy access to the water, makes new openings and enlarges the old ones, multiplies the currents, moves the eggs, brings them sometimes to the surface, at other times carries them to the bottom, thus supplying them, by varying their position, with the conditions suited to this period of their development. Finally, when the eggs are hatched, he still continues to watch over them in his nest, and does not allow them to go at liberty till they have become sufficiently active to provide the means for their own preservation."—For the entire paper, see *Jameson's Journal*, No. 84.

PECULIAR ORGAN FOUND IN THE RAYS.

M. le D. Cu. Robin has communicated to the *Annals and Magazine of Natural History*, an inquiry into an Organ upon each side of the tail of the Rays, (Raia, *Cuv.*) which is not mentioned in any of the works which the author has consulted. We quote his conclusions:—To sum up the matter, there exists in the Rays, a pretty voluminous organ, situated in the tail of that fish, as in that of the *Gymnotus*. [From a letter which I have received from Prof. J. Müller, Rüppell would appear to have described an organ analogous to the former in the tail of the fishes of the genus *Mormyrus*.] This organ of the Rays receives fine but very numerous nerves. It is formed of a gelatinous semitransparent and firm matter, as in all the electrical organs known.. This substance is, as in all these fishes, divided into polygonal discs, regularly piled together, against which nerves ramify that terminate by successive bifurcations and anastomoses supplied from their elementary fibres. How can we help seeing in this an electrical apparatus? It is true that its position is not the same as in the Torpedo, but in the *Gymnotus* and the *Silurus* the organ is also situated in the tail or around the body. These conclusions are farther confirmed by the following facts: I have proved that this apparatus is wanting in the tail of the Torpedo and the genera *Mustelus*, *Scyllium*, *Squatina*, *Zygæna*, *Acanthias*, and *Carcharias*.

The presence of this apparatus in the tail of the Rays explains the immoderate proportional length of this organ, its flattened form beneath, and the absence of the inferior lobe on the caudal fin, which scarcely exists in the Rays. The anal fin is also wanting in the Rays, it is also wanting in the Torpedos; but all these fishes have a complete caudal fin, whereas it is wanting in the Rays, as I have just observed.

I am indebted to the kindness of M. Bibron for being enabled to ascertain that the other fishes allied to the Rays (*Cephaloptera*, *Myliobates* and *Pastinacus*) whose tail is terminated by a thin and extended whip or prolongation, do not possess this apparatus. The whip is formed of a

portion of the tail, which the electrical apparatus would occupy if it existed.

As we have just seen, this organ cannot be regarded as a gland, for it has not the structure of one; it does not possess an excretory duct, it does not communicate in any part with the inside, and no gland receives so many nerves of animal life.*

THE NAUTILUS POMPILIUS.

Prof. Van der Höven has communicated to the British Association, the following—"On the Structure of Nautilus Pompilius." "My friend, De Vriese, lately gave me a specimen of *Nautilus pompilius*, which was in a bad state of preservation; but still of great interest to me, as I found occasion to observe a conformation of the head quite distinct from that which has been described by Owen and Valenciennes. As to the external tentacula, I found only this very unimportant modification—that there were but nineteen at each side, instead of twenty. Internal to this part, whose upper or dorsal part, called hood by Owen, fills entirely the opening of the shell, the integument forms a prolongation, rising up to another more internal circle. To the ventral or inferior side, this prolongation unites by a transverse part with the external tentacular ring. This part shows many transverse impressions parallel to the margin, and many irregular excavations, which gives to it a reticulated appearance. The prolongation is divided on each side into eight digitations of different size, inclosing each a tentacle similar to that of the internal set, but of a more minute size. Those parts correspond to the *superior labial processes* of Owen, (Memoir on the Pearly Nautilus, Tab. iv. g. g.;) but in Owen's description, and also in that specimen which has been described by Valenciennes, there are many more tentacula—twelve in Owen's specimen, and thirteen in that of Valenciennes. The last-named author calls this part the superior pair of the internal arms. Toward the inferior part of the head, nearer to the infundibulum, which is situated at the median ventral line, there are two other processes in Owen's and Valenciennes' specimens:—the inferior labial processes of the former—the inferior pair of the internal arms of the latter. Owen attributes, also, twelve tentacula to each of these processes. In this point my specimen is entirely different. On the right side I found four tentacula; three on a common flat pedunculus; the fourth and inferior on a separate digitation. I also cannot agree with Owen in calling these *inferior* labial processes—*interior* as they were in his specimen. In the specimen examined by me, they were, on the contrary, more interior than the superior labial processes. But at the left side a still greater difference was to be observed. Instead of a labial process, there was a great conoid body compressed from each side: at the basis, its measure, from the dorsal to the ventral surface, was one inch ten lines; from the right to the left only one inch. This part was proved, by dissecting it, to be formed

* Nevertheless the proof of its being an electrical organ must depend upon its power of giving electric shocks. Such a property, in our common Rays, if it existed, could hardly have escaped the notice of fishermen, in the constant habit of handling large Rays, Skates and Thornbacks, immediately after their capture.—*Ed. Annals and Mag. Nat. Hist.*

by the union of four unusually developed tentacular slips; one of which was shorter and more free; the three others chiefly composed the singular body. This part occupied a great space in the interior of the tentacular circle of the head; and, perhaps, its great development may be the cause of the more imperfect state of the other three pair of labial processes."

Prof. Owen regarded the observations of Prof. Van der Höven as of more importance than those of Valenciennes. The difference of number in the tentacles proved that there was a range of variation in this respect; and, therefore, not to be relied on. He had examined a second specimen of the Nautilus, and had found that the labial processes were inferior and not interior, as stated by Prof. Van der Höven. He felt deeply indebted to the Professor for the kind manner in which he had brought forward the points in which he differed from himself.—*Athenæum*, No. 1028.

CHITON AND CHITONELLUS.

A PAPER has been read to the Linnæan Society, "On the Structure and Comparative Physiology of *Chiton* and *Chitonellus*, two genera of pectinibranchiate molluscs," by Mr. Lovell Reeve. Some important facts in the nature and habits of these animals were communicated in this memoir in support of their hitherto disputed claim to generic distinction; chiefly elicited from the observations of Mr. Cuming at the Philippines, and of Capt. Sir Edward Belcher, of H.M.S. Samarang, in company with his assistant-surgeon, Mr. Arthur Adams, among the islands of the Korean Archipelago in the Yellow Sea.

The *chitons* and *chitonelli* differ materially in habit: the former live attached to stones or fragments of shells, on exposed rocks, or under stones; the latter are of a more locomotive disposition, and retire into holes and cavities. The *chitonellus fasciatus*, the largest species known, thrusts itself into orifices in masses of coral, attenuating itself in any circuitous direction to the length of a foot or more, and only to be obtained entire by splitting the mass in which it has become imbedded; and when discovered in any other situation, by lifting a large stone, it would crawl away at about the pace of the common garden-snail in search of retirement. The author concluded by stating that he considered the *chitonellus* entitled to a rank fully equivalent to *chiton* in its most extended form, and one superior in estimation to that of the genera into which it had been subdivided by Mr. Guilding, Mr. Gray, and Mr. Salter, both in structure, as regards the condition of the mantle and its system of calcification, and in habit.

THE BRITISH TRITON.

THERE has been read to the Royal Society, a paper of "Researches to determine the Number of Species and the Mode of Development of the British Triton," by Mr. J. Higginbottom, F.R.C.S.

The observations of the author, of which he gives a detailed account in the present memoir, have led him to the following conclusions:—

Two species only of the genus Triton are met with in England; namely, the *Triton verrucosus* and the *Lisso-triton punctatus*. It is three years before the animal is capable of propagating its species, and four years before it attains its full growth. In its tadpole state, it remains

in the water till its legs acquire sufficient strength to qualify it for progressive motion on land. While a land animal, it is in an active state during the summer, and passes the winter in a state of hybernation; but it does not then, as has been erroneously supposed, remain at the bottom of pools. Very dry or very wet situations are incompatible with the preservation of life during the period of hybernation. At the expiration of the third year, the triton revisits the water, in the spring season, for the purposes of reproduction, and again leaves it at the commencement of autumn. Impregnation is accomplished through the medium of water, and not by actual contact. The growth and development of the triton are materially influenced by temperature, and but little by the action of light. The triton possesses the power of reproducing its lost limbs, provided the temperature be within the limits of 58° and 75° Fahrenheit; but at lower temperatures, and during the winter, it has no such power.

NEW GENUS OF FRESH-WATER ALGÆ.

Prof. Allman has stated to the British Association, that the subject of this communication was to be seen in the form of very minute gelatinous elevations on the submersed stems of certain water-plants. When examined under the microscope, it is found to consist of a kind of dichotomously branched prostrate stolon, with the cells much contracted at the articulations. Each of these cells gives origin to an articulated filament, with the articulations not contracted, at first simple, but in mature plants dichotomously branched. The whole is surrounded by a delicate mucous investment like that of a *chætophora*, to which genus the present plant is evidently allied. Two forms marked by specific differences would seem to exist. One of these was obtained by the author in July, 1846, near Roscrea, in the county Tipperary; and the other was discovered by Mr. Robert Callwell, in a small pond in the Zoological Gardens, Dublin.

THE LEPIDOSIREN.

Dr. A. G. Melville has stated to the British Association, that on a careful examination of the *Lepidosiren annectens*, he had come to a different conclusion from that held by Prof. Owen on the position of this anomalous animal in the sub-kingdom Vertebrata. He had no hesitation in referring it to the class of Amphibia, and was unwilling to limit that class to the closely allied one of Fishes. He rested its reptilian character upon the absence of the supra-occipital bone, the presence of the large epi- and basi-cranial bones, the non-development of the maxillary and inter-maxillary bones, and especially on the enormous magnitude of the Wernerian bones, which became subservient to mastication, and were anchylosed to the expanded pterygoids: also on the composition of the tympanian pedicle: on the nostril being doubled and the posterior aperture intra oral—and referred to Rusconi's remarks on the position of that aperture as influenced by the relative development of the superior maxilla and vomer: on the double auricle, septum ventriculosum, semi-spiral bulbus arteriosus, and on the arrangement of the vessels distributed to the external and internal gills and to the lungs; and in addition to the left pulmonary artery pointed out by Peters, he had found a right one,

having, like its fellow, its origin from the truncus aortæ: on the existence of external cutaneous gills during the adult condition, which did not occur in any fish, and were not the homologies of the deciduous filaments found in sharks and rays: on the co-existence of external and internal gills with lungs—in other words, on its exhibiting the different modes of circulation, respiration, &c. in the Proteus—second stage of the larva of the frog and amphiama or menopoma—(he instanced the like case of the tadpole, of the *Rana paradoxa*, in which there were internal gills and lungs with a cartilaginous chorda dorsalis, ossified neurapophysis, and protruded hinder extremities; were this arrested in its development before the external gills have wholly disappeared, we should have an animal essentially similar to the Lepidosiren):—on the form and relative size of the brain in relation to its containing cavity, and mentioned certain calcareous concretions which overlie the fourth ventricle, &c. &c. Many of the peculiarities were to be classed among the adaptive characters;—and for some excellent remarks on this subject in reference to the osseous system in another tribe, to wit, the Plagiostomous fish, he would refer to Mr. Owen's "Lectures," vol. ii. The absence of respiration by the surface, as in other Amphibia, might have an influence on the great development of the respiratory organs. In conclusion, although the Lepidosiren is the most fish-like of the Amphibia, still Dr. Melville is forced to regard it as a true amphibian, and not as a fish, and thus reverts to the determination of Bischoff.

The Prince of Canino stated, that although Oken had pointed out the nostril with two openings as a character of the Reptilia, he had received a letter from that naturalist, in which he declared his belief that the Lepidosiren was a fish and not a reptile, and that the double opening of the nostril was apparent and not real.

Prof. Owen thought the mere possession of a double nostril would not be sufficient to place this animal with the reptiles. He, however, denied that this was the case. The scales of the Lepidosiren were those of a fish. The breathing organs he deemed to have no more of the character of lungs than the organs possessed by many fishes which occasionally lived on land. The circulation was not decidedly reptile, and approached in character that seen in some of the plagiostomous fishes and the young of most fish. He did not think the size of blood globules or the cells of the bone of sufficient importance to decide the class of Lepidosiren. Neither could a better case be made out for the heart or brain;—in the structure of both of which organs there was an identical character with many fishes. The spiral character of intestine was certainly a good distinction as far as existing Reptilia; and he was not certain that the form of the coprolites of the Ichthyosaurus depended on this structure. From the osteological characters of the head, he also concluded that the Lepidosiren was a fish, and not a reptile.—*Athenæum*, No. 1027.

SWARM OF LADYBIRDS—(COCCINELLÆ).

A CORRESPONDENT of the *Athenæum*, No. 1035, writes, that on Friday, August 8, 1847, he was at Broadstairs, in the Isle of Thanet. The wind was in the north-east; and a good deal of rain fell, after a

drought in that district of six months' duration. On the Saturday it became fine, with a strong wind from the south-west. Early in the morning, a few Ladybirds made their appearance. Their number kept increasing during the whole of Saturday, Sunday, and Monday; when the esplanade and cliffs on the west side of the town were literally covered with them. They were evidently borne upon the wind, and were most numerous at the edges of the cliffs—as if they caught there as a last refuge before being carried out to sea again. The stalks of the dried plants were covered with these insects; and the stem of the *Dipsacus Centaurus*, and other plants, looked as if they were borne down by a crop of red berries. The white dresses of the ladies attracted them especially, —and gave no little annoyance to those who were afraid of them. They are, however, perfectly harmless; and, excepting for their disagreeable smell, need not be avoided. These creatures are carnivorous, and, of course, could not find food in such immense quantities; and many of them found were reduced to the sad extremity of feeding on their departed friends, whose dead bodies were strewed about the paths in all directions. They were preyed upon in great numbers by a black beetle. They were not all of one species. The common one, with a yellow body and seven black spots, was most abundant; next to that came the species with two black spots; the species with nine spots was scarcer still; and there were only a few specimens of one with a black body and orange spots. The intensity of their colouring varied from a light yellow to a deep orange.

The Ladybirds continued at Broadstairs till Thursday, August 12, when a strong wind from the south setting in, cleared the whole district. They, however, found a resting-place at Margate, where, in a line from the Fort to the railway terminus, they covered everything, and the air was filled with them. Up to this time none, or not an unusual number, of these creatures had been seen at Ramsgate; but on Saturday the wind having got into the east on the previous evening, they began to appear there, and on that evening they seemed to be as numerous at Ramsgate as at Broadstairs and Margate. On the 17th and 18th of August, there was a smaller swarm of these insects at Broadstairs, the wind blowing in a north-westerly direction.

From several accounts in the *Daily News* of the 16th and 17th of August, it appears that on Friday, August 13, the same insects were observed at Southend; on the same day in great numbers in London; and on the following Saturday and Sunday at Brighton.

Large flights of these creatures are not uncommon. Various swarms of them have been recorded as occurring at Brighton, where they were supposed to have been carried from the neighbouring hop-grounds, as the larva of the Ladybird feeds on the aphides, which are so destructive of the hop-plant. On the present occasion, however, it appears that these insects must have been brought by the south-west wind from the continent. That the direction of the wind determined their appearance, is evident from the fact that they disappeared at Broadstairs on the day they were seen at Margate, and were not found at Margate after their appearance at Ramsgate. The cause of the swarming of these insects is probably a scarcity of their natural food during the prevalence of a strong

wind, which, sweeping over a large tract of the earth's surface, carries along with it all who are disposed to go. That this is the case seems confirmed by the fact, that at first these insects only appeared by degrees; a few arriving, and the number gradually increasing, on a particular spot. In the Isle of Thanet, some of the common people regarded this visitation as foreboding the death of a great personage. Such a flight occurred just before the death of George the Third.

THE COCHINEAL INSECT.

Mr. Westwood has exhibited to the Entomological Society, specimens and drawings of the Cochineal Insect, brought from Madeira by Mr. Faber. He has ascertained that its habits are unlike those of the ordinary Coccidæ; as the females bring forth living young, which are not deposited beneath the body, but which creep up the plant as soon as born. Moreover, the male pupæ are inclosed in a bag-like cocoon, open at the lower end, out of which the imago creeps backwards, with its wings thrown over its head: hence, Mr. Westwood considered it necessary to separate this insect generically from the other Coccidæ; and has proposed the generic name of Pseudo-Coccus for its reception.

COMMERCIAL VALUE OF INSECTS.

The importance of Insects, commercially speaking, is scarcely ever thought of. Great Britain does not pay less than 1,000,000 of dollars annually for the dried carcases of the tiny insect, the Cochineal; and another Indian insect, which affords, by puncturing particular trees, *Lac*, is scarcely less valuable. More than 1,500,000 of human beings derive their sole support from the culture and manufacture of silk; and the silkworm alone creates an annual circulating medium of nearly 200,000,000 of dollars; 500,000 dollars are annually spent in England alone for foreign honey; at least 10,000 cwt. of wax is imported into that country every year. Then, there are the gall-nuts of commerce, used for dyeing and making ink, &c.; while the Cantharides, or Spanish fly, is an absolute indispensable in Materia Medica.—*Boston Transcript; Athenæum*, No. 978.

NEW INSECTS.

Mr. Bond has exhibited to the Entomological Society, a species of *Noctua* new to this country, captured at Yaxley Mere, and a new species of the singular genus *Achias*, by Mr. Westwood, for the collection of Dr. Horsfield, now deposited in the East India Company's Museum, in Leadenhall Street. Mr. Saunders exhibited a bottle of Cayenne Pepper, portion of a large quantity imported by the East India Company from India, which was found to be greatly infested with a small beetle belonging to the family *Ptinidæ*, the larvæ of which feed upon it, notwithstanding its pungent properties. He also exhibited living specimens of two beautiful species of *Bruchus*, which feed upon leguminous seeds, received by Dr. Royle, from the Himalayas. Mr. Westwood mentioned an instance of the injury done to growing bean-plants by a small weevil which burrows into the base of the stem.

BOTANY.

IMPROVEMENT OF THE ROYAL BOTANIC GARDENS AT KEW.

This Establishment, under the direction of Sir W. J. Hooker, has, unquestionably, become the first Botanic Garden in Europe. One of its latest acquisitions is a Cactus, weighing a ton, as stated by Sir W. J. Hooker, in his Report laid before Parliament; who adds that the collection of that most singular family, so recently made familiar to us, (he refers to the collection at Kew) "is now unrivalled in Europe."

Several new species of plants have been received in the state of specimens for the Herbarium, from China, South America, and New Zealand; but chiefly from Australia.

In the diffusion of the riches of the vegetable world, steam navigation has obviously been a most favourable auxiliary; so that "even cuttings of plants" are now "actually sent successfully to Calcutta, Ceylon, &c." In speaking of the exports from Kew, it is not unfitting to add, that "between four and five thousand plants of the famous Tussae grass have been dispersed from the Royal Gardens at Kew during the past year."

The increase in the number of visitors to this flourishing establishment has been very great. In 1841, the number of visitors was 9,174; in 1844, they were 15,114; in 1845, 28,139; in 1846, 46,573.

In the true spirit of popular enlightenment, Sir W. J. Hooker has published a Guide to the Royal Botanic Gardens, with descriptions, cuts, and plan, at a very moderate price.

FECUNDATION OF PLANTS.

Sir R. H. Inglis, in his address to the British Association, observed: "In Vegetable Physiology, microscopic observers have of late been much occupied in investigating the phenomena of Fecundation, and especially as to the mode of action of the pollen.

"On this subject, botanists are still divided. Several experienced observers adopt the theory lately advanced and ingeniously supported by Prof. Schleiden, of Berlin; while others of great eminence deny the correctness on which this theory is founded. Among these, the celebrated microscopic observer, Prof. Amici, of Florence, very recently in an essay, communicated to the Scientific Meeting held in 1846, at Genoa, has endeavoured, by a minute examination of several species of Orchis, to prove the existence of the essential part of the embryo anterior to the application of the pollen, which, according to him, acts as the specific stimulus to its development.

"This view receives great support from some singular exceptions to the general law of fecundation.

"Of these, the most striking occurs in a New Holland shrub, which has been cultivated several years in the Botanic Garden at Kew; and which, though producing female flowers only, has constantly ripened seeds, from

which plants have been raised perfectly resembling the parent: while yet there is no suspicion either of the presence of male flowers in the same plant, or of minute stamina in the female flower itself, nor of fecundation by any related plant cultivated along with it.

"This plant has been figured and described in a recent volume of the Linnean Society's 'Transactions,' under the name of *Cælebogyne ilicifolia*, by Mr. J. Smith, the intelligent curator of the Kew Garden, by whom, indeed, this remarkable fact was first noticed. It is not the least curious part of the history of the *Cælebogyne*, that male flowers have lately been discovered in New Holland, unquestionably of the same species.

"Prof. Gasparini, of Naples, has more recently communicated to the scientific meeting held in that city in 1845, his observations and experiments on the cultivated fig, which, though entirely destitute of male flowers, produced seeds having a perfectly developed embryo, independent of fecundation; access to the pollen of the wild fig, generally supposed to be carried by insects, being, in his experiments, prevented by the early and complete shutting up of the only channel in the fig by which it could be introduced."—*Athenæum*, No. 1026.

SEPARATION OF SILICA FROM PLANTS.

Dr. C. T. Jackson has described a new method of separating Silex from the stems of reeds, rushes, straw, and grass, which he had contrived while aiding the manufacture of paper and hemp from reeds. He thinks it may prove a convenient mode of demonstrating the presence of silex in plants to a class in the lecture-room, and that it can be applied in chemical analysis of such plants as have a covering of silex. The process is as follows:—

The reeds are crushed or split, moistened with water, and placed in a leaden tube or cylindrical reservoir, and a smaller tube is connected with one end of it and carried down into a glass of water. Then a leaden bottle, being charged with pulverized fluor-spar and concentrated sulphuric acid, is connected with the opposite end of the reservoir, and the bottom of the bottle is carefully heated by a spirit-lamp, or by means of sand heated below the melting point of lead. The fluo-hydric acid gas passes over and through the reeds in the reservoir, and takes up all the silex in the state of fluo-hydrosilic acid gas, which passing into the water is decomposed, and hydrate of silica is deposited as a gelatinous mass, separable by means of a filter. The vegetable fibre, on being removed from the reservoir and washed, is destitute of silica.—*Proceedings of the Sixth Annual Meeting of the Association of American Geologists and Naturalists.*

DIMOCARPUS.

There has been exhibited to the Horticultural Society, from the Duke of Northumberland's garden, at Syon, a plant of Litchi in fruit, a species of Dimocarpus, whose fruit is much esteemed by the Chinese, and of which there is more than one variety. The fruit was about the size of a walnut, round, with a rough shell or coat enclosing a stone, about which is the pulp or eatable part. The other production was a cut laurel-like

branch, bearing two fruit of the common nutmeg, which is perhaps the first time this spice-tree has fruited in England. Before the fruit opens it looks not unlike a little peach; but as maturity approaches, the outside covering is burst into two halves, displaying to view a reddish purple body something like a plum; and within this, which after a certain process becomes the mace of the shops, the true nutmeg is enclosed. The fruit is about as large as a good-sized fig, and perhaps more pear-shaped than round. It was mentioned that there is a larger variety of Nutmeg in fruit at Syon.

DIATOMACEÆ.

Dr. Hooker has read to the British Association, a paper which is thus reported in the *Literary Gazette*, No. 1592 :—

Dr. Hooker remarked, that though terrestrial plants in the southern hemisphere scarcely entered the Antarctic Circle, yet that within that parallel, and indeed up to the highest latitude hitherto attained, the ocean abounded in a very peculiar vegetation. The existence of these plants was one of the most singular features of the South Polar Sea; whilst by their decomposition they were forming deposits of organic remains in all respects analogous in composition to the infusoria rocks of Ehrenberg; as the Tripoli stone, &c. The *Diatomaceæ* probably swim over the whole ocean, for they were found by the author in the stomachs of various *molluscæ* throughout nearly 100 degrees of latitude, namely, from the north tropic to Victoria Barrier. Within the Antarctic Circle, however, they are rendered peculiarly conspicuous from their becoming enclosed in the newly-formed ice, and being washed up in myriads by the sea on to the pack and bergs, everywhere staining the white ice and snow of a pale ochreous brown. The collections made by Dr. Hooker were examined by Prof. Ehrenberg, who determined upwards of 150 different species, very many of them new to science, and others identical with what occur in all latitudes and in various formations. Prof. Ehrenberg's views of the animal nature of this order appear unfounded; the arguments adduced for their being plants being considered by most naturalists as almost conclusive, even previous to the remarkable discovery of Mr. Thwaites, whose having seen several species of *Diatomaceæ* to congregate in a manner altogether analogous to that pursued by certain other *algæ*, entirely removes all doubts of their vegetable nature.

Dr. Hooker remarks that the universal presence of this invisible vegetation throughout the South Polar Ocean, where every living thing appeared to be animal, is a most important feature; for that these plants probably there maintain that balance between the animal and vegetable kingdom which vegetables of a higher order effect in lower latitudes; not only by affording a protection for the herbivorous animals, but by purifying the atmosphere, which must be vitiated by the swarms of *moluscæ* and *crustaceæ*, whales and porpoises, which people the ocean, the seals and penguins which abound on the ice, and the flocks of birds which are dependent on the air and sea. With regard to the distribution of these Antarctic species, it is both wide in space and extended through time; some of the species are found through every degree of latitude between

Spitzbergen and Victoria Land; these or others have also occurred in various sedimentary rocks, Tripoli stone, phonolites, and volcanic ashes.

The next point to which the author alluded was the formation of a deposit or stratum of mud, consisting chiefly of the siliceous cells of *Diatomaceæ*, 400 miles long and 120 broad, at a depth of between 200 and 400 feet. This bank flanks Victoria Land and Victoria Barrier, in 78° south latitude, and was sounded over by the Antarctic Expedition in two successive seasons. Of its thickness no conjecture could be formed, but that it must be always increasing is evident, the silex of which it is in a great measure composed being indestructible. Its position, in connexion with the Victoria Barrier, is very suggestive; for that glacier, extending as it does in one continuous sweep from the tops of mountains 12,000 feet high, to the sea-level, upon whose surface its outer edge floats, must have a progressive motion. This movement, together with the accumulation of snows in a climate where snow is perennial, will result in the barrier interfering with the *Diatomaceæ* bank, and producing flexures and other disturbances in its form, which a future elevation of the land and change of climate may reveal.

Again, Dr. Hooker made some observations on the connection between Mount Erebus, an active volcano of 12,400 feet elevation, upon whose submarine flanks the *Diatomaceæ* bank rests, and that bank itself. Ehrenberg's discovery of *Diatomaceæ* in the ashes and pumice of active and extinct volcanos, suggests the question of the source from whence these were derived: that author concludes such species to be of fresh-water origin; but Dr. Hooker's results shew that no inconsiderable number of fresh-water species occur in the Antarctic Ocean; and adds, that we may further assume an occasional communication between the *Diatomaceæ* bank and the bowels of Mount Erebus to be possible, since we are aware that other active volcanos eject materials obtained from those seas to which they are adjacent.

THE KERGUELEN ISLAND CABBAGE.

In the Flora of the Antarctic Continent, (which numbers only 18, whilst Spitzbergen shows 45), among the flowering plants is one which demands particular attention—the famous Cabbage of Kerguelen Island, hitherto unpublished, first discovered during Captain Cook's voyage. Specimens, together with a manuscript description, under the name of *Pringlea*, were deposited, in the collection formed by Mr. Anderson, in the British Museum, where they still exist. To a crew long confined to salt provisions, or, indeed, to human beings under any circumstances, this is a most important vegetable; for it possesses all the essentially good qualities of its English namesake; whilst, from its containing a great abundance of essential oil, it never produces heartburn or any of those disagreeable sensations which our pot-herbs are apt to do. It abounds near the sea, and ascends the hills to their summits. The leaves form heads of the size of a good cabbage-lettuce, generally terminate an ascending or prostrate stalk; and the spike of flowers, borne on a leafy stem, rises from below the head, and is often two feet high. The root tastes like horse-radish, and the young leaves or hearts resemble in flavour coarse

mustard and cress. For one hundred and thirty days the crew of the *Erebus* and *Terror* required no fresh vegetable but this, which was for nine weeks regularly served out with the salt beef or pork; during which time there was no sickness on board.—*Sir J. C. Ross' Voyage to the Antarctic Continent.*

CLOVEWORTS ARE POISONOUS.

M. MALAPERT, conjointly with M. Bonnet, has shown that *Saponaria officinalis* and *Agrostemma Cithago* are poisonous, and ascribes this to their containing saponine. In the last plant, the saponine occurs principally in the ripe and immature seed, and also in the roots; but the other parts contain none. *Silene nutans* contains at least as much saponine as saponaria, but here it is diffused throughout the plant, except in the seed. The author, moreover, found this principle in *Dianthus caryophyllus, D. Cæsius, D. Carthusianorum, D. proliferus* (chiefly in the roots, less in the leaves, and not at all in the flowers and seed), *Lychnis dioica, L. chalcedonica, L. flos cuculi, Silene inflata, Cucubalus Behen,* and in *Anagallis arvensis* and *A. cærulea,* but not in Arenaria, Stellaria, and Holosteum. Fremy found saponine in the horse-chesnut; the author has also detected it in the fruit, but in no other part of the tree.—*Journal de Pharm., in Chemical Gazette.*

THEOBRAMA CACAO, AND THE PAPAW.

THERE has been exhibited to the Horticultural Society, from the Duke of Northumberland's garden, at Syon, a novelty in the shape of a *ripe* fruit of *Theobrama Cacao,* a small tree of which whole forests occur in Demerara; it is common also in Guatamela and Mexico. The tree at Syon is stated to be between three and four years old, and about seven feet high, with a clean stem for about five feet in height; the fruit, which is believed to be the first that has ripened in Europe, was opened for the purpose of exhibiting the arrangement of the seeds, which, when roasted, are the cocoa of commerce. They were found to be imbedded in pulp, occupying the whole interior of the outside covering. From the same collection were also flowers and ripe fruit of the South American Papaw Tree (*carica papaya*); whose fruit is eaten as a *vegetable,* and when cooked is esteemed by some, but appears to have little to recommend it. The tree was mentioned to have the singular property of rendering the toughest animal substances tender, by causing a separation of the muscular fibre; its vapour even does this: newly-killed meat suspended among the leaves, and even old animals when fed on the leaves and fruit, are reported to become tender in a few hours. The tree has large handsome palmate leaves, and sterile and fertile flowers in different clusters, the latter being much larger than the former. It was mentioned that at Syon there was a smaller-fruited variety than the one sent. A Knightian medal was awarded for the specimen.

CULTURE OF THE TEA-PLANT IN INDIA.

DR. WILLIAM JAMESON, (nephew of Professor Jameson), Superintendent of the Botanic Gardens in the north-west provinces of India, has

proved the capabilities of the valley of the Dhoon, and the adjacent districts, for the production of Tea. The tea-brokers in England have pronounced this equal to China tea of a superior class, possessing the flavour of the orange-pekoe, but more than the usual strength of that tea; in other respects resembling that imported as Ning Yong. The capacity of the provinces of Kemaoon and Gurhwall for the enlarged production of the article, does not, moreover, appear to be limited to particular localities. According to the latest report which has been furnished to the Court of East India Directors, 176 acres were under cultivation, containing not fewer than 322,579 plants. The crop is thriving in different places over four degrees of latitude and three degrees of longitude, and 100,000 acres are now available in the Dhoon alone, for the purposes of tea cultivation. At a maund an acre, they would yield 7,600,000 lb., which is equal to *one-sixth* the entire consumption of England. If the application of capital to this object receive a sufficient impulse, we might, in the course of ten or twelve years, have the gratification of seeing England draw the largest portion of her supplies from this country, and a new trade of £3,000,000 or £4,000,000 sterling a year, grow up in India, stimulating industry and diffusing plenty, and increasing the mutual benefit which the two countries derive from each other.

But the country itself would reap no small advantage from the facility of obtaining supplies of Tea at a reasonable rate. The natives of India are partial to this beverage, and the use of it will be extended in exact proportion to the degree in which it is brought within their means. A rupee and a half a seer, at which rate Dr. Jameson calculates that the cultivation will yield a profit of nearly two hundred per cent., would place the Kemaoon tea within the reach of the whole body of the middling classes: and the demand for it, in the country itself, would be sufficient to furnish the highest encouragement to perseverance, independently of the European market.—*Friend of India, Serampore*, Feb. 4, 1847.

THE MULBERRY AND THE SILKWORM.

A COMMUNICATION from Mrs. Whitby has been read to the Royal Institution, "On the Cultivation of the Mulberry, and the growth of the Silkworm in this country." The result of the last two years' trials has been highly satisfactory in regard to the cultivation of the mulberry and the produce and quality of the silk drawn from cocoon. Cuttings of the *morus multicaulis* or mulberry of the Philippine Islands, put into a cucumber frame with slight heat in October 1844, and thence transplanted into the open ground in the following spring, have yielded on an average ten cuttings each plant; two pounds weight of leaves having been previously gathered from each plant to feed the silkworms. The plants originally imported in 1836 have spread so much that the dwarfs have been obliged to be thinned, and they have produced shoots during the past summer of from six to eight feet long. One acre of land planted with 2400 of the *morus multicaulis* will, at the end of two years' growth, yield from 20,000 to 24,000 cuttings, sufficient when rooted up to plant another acre. In 1846, Mrs. Whitby goes on to state, she made several experiments to ascertain the relative value of eggs procured from four

different places; and gives the following comparative weight and number of the cocoons produced, all the worms being treated in every respect alike:

No.	Cocoons.		Oz.		Cocoons.		Oz.	
1 English.....	77	weighed	2	and	77	produced	0¼	raw silk.
2 Poictiers.....	55	,,	2	,,	460	,,	1¾	,,
3 Bordeaux....	47	,,	2	,,	480	,,	1¾	,,
4 Italian.....	45	,,	2	,,	213	,,	1	,,
5 Bengali	340	,,	2	,,				

The Bengali cocoons were so inferior to the others that they were not wound off. The communication concluded with a reply to the following question: "How the English grower could compete with the Bengali grower, the latter having four crops and the former only one annually," viz., one cocoon reared in England is equal in weight to four of the Bengali, and the raw silk sells at from 23s. to 25s. per pound, whilst the Bengali raw silk fetches only from 10s. to 11s. per pound.—*Literary Gazette*, No. 1567.

GUTTA PERCHA.

This new substance in the arts has been mentioned in the *Year-book of Facts*, 1846, p. 73; and in the *Year-book*, 1847, p. 105. Of the Gutta Percha plant, specimens are now flourishing in the Royal Botanic Garden at Kew.

Sir W. J. Hooker states the trees from which Gutta Percha is procured to belong to the natural order *Sapotaceæ*, found in abundance in the island of Singapore, and in some dense forests at the extremity of the Maylayan peninsula. Mr. Brooke reports the tree to be called *Niato* by the Sarawak people, but they are not acquainted with the properties of the sap: it attains a considerable size, even as large as six feet in diameter; is plentiful in Sarawak, and most probably all over the island of Borneo. The tree is stated to be one of the largest in the forests in which it is found. The timber is too loose and open for building purposes; but the tree bears a fruit which yields a concrete oil, used for food.

Gutta Percha is contained in the sap and milky juice, which quickly coagulates on exposure to the air; from twenty to thirty pounds being the average produce of one tree. For collecting the sap, the trees are felled, barked, and left dry, and useless; so great is the demand for the Gutta, the importation of which already reaches many hundred tons annually. Hence, the forests will soon be cleared of the Gutta trees; whereas, it is believed that a constant and moderate supply might be secured by incisions in the bark, as in the case of Caoutchouc.

The Gutta is received in scraps, or in rolls of thin layers. It is first freed from impurities by deviling or kneading in hot water, when it is left soft and plastic, and of a whitish grey colour.

When thus prepared, the Gutta has many curious properties. Below the temperature of 50 degrees it is as hard as wood, but it will soon receive an indentation from the finger-nail. When softened in hot water, it may easily be cut and moulded; and it will harden as it cools, to its former rigidity; and it may be softened and hardened any number of times without injury to the material. Unlike caoutchouc, it has little elasticity;

but it has such tenacity, that a slip, one-eighth of an inch substance, sustained 42lb. weight, and only broke with a pressure of 56lb. When drawn out, it remains without contracting.

In solution, Gutta Percha is applied, like caoutchouc, for waterproofing cloth. It is likewise used for numerous purposes for which leather is used; in mastics and cements, &c. In short, it promises to become as important an article of commerce as caoutchouc itself. It has been suggested to Dr. Montgomerie, that the Gutta Percha would be found useful in stopping decayed teeth.—*The Illustrated London News*, No. 287.

Mr. Busk has read to the British Association, a paper "On the Application of the Gutta Percha to Modelling." After alluding to his experiments, he described the mode he followed in obtaining his moulds: "It is to be rolled out on a smooth surface in sheets of any convenient size suitable to the object to be taken, and varying in thickness according to the size. For small objects, from the $\frac{1}{12}$ to $\frac{1}{16}$ of an inch is thick enough. The sheet is dipped for a moment or two into *boiling* water, and placed warm upon the object, upon the surface of which it is to be carefully pressed with the finger point, or a convenient elastic pad, so as to insure its close and uniform adaptation. In moulding soft objects, it is, of course, necessary that they should possess elasticity or resiliency, as is the case with living or recently dead animal bodies. The Gutta Percha does not seem to be applicable to taking moulds from very fragile bodies, such as many fossils, which would not bear the requisite pressure, nor admit of the removal of the mould when rigid, without risk. The most delicate objects, however, and slender projections, if firm enough in the original, may in the plaster cast be removed from the matrix without any difficulty, when the latter is softened by momentary immersion in hot water.

Mr. Jerdan stated that there were two kinds of Gutta Percha—one white, the other black. The former was the best for modelling. He had written to Mr. Brooke, of Borneo, on the subject, who informed him that an unlimited supply might be obtained from that country. Mr. Crawfurd said it was not hard till after it was submitted to the heat of boiling water. The proper way of pronouncing the word was gutta pertsha, which was a Malay term, and signified ragged gum.

PARASITIC FUNGI.

The Rev. E. Sidney has read to the Royal Institution, a paper on this subject, in which the peculiar feature was a summary—1. *Of the Fungi infesting timber*. It was alleged that not only the *Merulius lacrymans* and *Polyporus destructor*, but any fungi found on decaying trees, were capable of producing dry-rot. From small white points there radiates a filamentous substance parallel with the surface of the timber. This is the spawn of the fungus. It soon gains strength, and penetrates the intercellular passages of the wood, and thus disintegrates the timber. Mr. Sidney suggested that the development of these fungi might depend on the condition of the sap in the wood. He adverted to the experiments of Dutrochet on the growth of fungi in acid and alkaline solutions, as tending to elucidate the phenomena of dry-rot. He contended that whatever might be the efficacy of Kyan's principle, much might be effected by insti-

tuting experimental research into the best times for felling trees ;—spring was alleged to be the worst season.

2. *On the Fungi infesting the culinary department.* Bread is attacked by a *Penicillum*, as well as by two or three other moulds. French troops experienced great injury from bread thus poisoned. The fungi attacking meat are chiefly, according to Mr. Sidney, Agarics in a rudimentary state. *Penicillum glaucum* is, however, found destroying salt provisions.

3. The *Fungi infesting cellars* are probably *Polypori*, and other fungi in various stages of growth. Mr. Sidney showed that, when pressed into a state of sufficient consistency, these fungi formed excellent tinder. None of these fungi will grow where rock-salt is present. Fermentation is generally attended by the growth of molecular spores. It is remarkable that both the yeast and the vinegar fungus are mere states of *Penicillum glaucum ;* the mode of their growth being modified by the peculiarity of the medium in which they are developed.

Mr. Sidney noticed the following experiment, made to ascertain whether the so-called vinegar-plant was able to produce fermentation :—Four equal quantities of sugar and water became acidified in the following order —*a*, when containing washed fungus ; *b*, containing yeast ; *c*, containing fungus unwashed ; *d*, when left to itself. In these cases, *Penicillum glaucum* at length appeared. 4. *Fungi infesting store-rooms, &c.* These are chiefly infested by *Penicillum glaucum*. Its growth is said to be prevented by any essential oil. Sugar is attacked by *Torula sacchari*. Fruit is subject to several fungi. It is remarkable that the brown matter on attacked apples and pears has been found to produce potato disease by inoculation. Mr. Berkeley's recent experiments on *Bunt*, show that fungal disease may be propagated by the mere grumous matter in spores. 5. *Fungi attacking books and the object-glasses of telescopes.* The former are hairy fungi ; the latter the small *Penicillum* growing on the particles of dust which insinuate themselves into the glass. 6. *Fungi attacking the wardrobe, and the contents of the dairy.* Mr. Sidney referred to the *Penicillum* as appearing on leather, and to the *Torula* as infesting cheese. The speculation of the convertibility of milk globules into fungi was noticed as an unsubstantiated hypothesis.—*Athenæum*, No. 1022.

ESCULENT FUNGUSES.

THE great drawback on the use of these Esculents in this country is, that some are poisonous, and few persons possess the skill to distinguish them, with the exception of one or two species, from those which are edible. In the market at Rome there is an "inspector of Funguses," versed in botany, and whose duty it is to examine and report on all such plants exposed for sale. The safety with which these vegetables may be eaten has led to a very large consumption in that city, where not less than 140,000 pounds weight, worth £4000 sterling, are annually consumed, and this in a population of 156,000 souls. We cannot estimate the value of funguses in our own country for an article of diet as less than in Italy ; nor believe that the supply would be in a less ratio. If this be correct, the value of the funguses, which are allowed to spring up and die, wasted in Great Britain, would be about half a million sterling in each year.—*Athenæum*, No. 1037.

PHOSPHORESCENT FUNGUS.

Mr. Gardner, in his *Travels in the Interior of Brazil*, found fungus belonging to the genus *Agaricus*, and was told that it grew abundantly in the neighbourhood, on the decaying leaves of a dwarf palm. It varied from 1 to 2½ inches across. The whole plant gives out at night a bright phosphorescent light, of a pale greenish hue, similar to that emitted by the larger fire-flies, or by those curious soft-bodied marine animals, the *Pyrosomæ*. From this circumstance, and from growing on a palm, it is called by the inhabitants "Flor de Coco." The light given out by a few of these fungi, in a dark room, was sufficient to read by. It has been described by the Rev. Mr. Berkeley, under the name of *Agaricus Gardneri*, from preserved specimens. Mr. Gardner had already named it *A. phosphorescens*, not being aware at the time he discovered it that any other species of the same genus exhibited a similar phenomenon; such, however, is the case in the *Agaricus Olearius* of De Candolle; and Mr. Drummond, of the Swan River Colony, in Australia, has given an account of a very large phosphorescent species, occasionally found there.

FALL OF MANNA.

Several occurrences of what is called a Fall of Manna are attributable to the accumulation of the lichen, *Lecanora esculenta Aucher-cloi*,* observed in Persia in layers of nearly inches (0m. .12 to 0m. ·13) in thickness. Specimens, with the following note, have been sent to France:—"In 1829, during the war between Persia and Russia, there was a great famine in Oroomiah, south-west of the Caspian. One day, during a violent wind, the surface of the country was covered by a lichen, which fell from *heaven*. The sheep immediately attacked and devoured it eagerly, which suggested to the inhabitants the idea of reducing it to flour, and making bread of it, which was found to be good and nourishing. The country people affirm that they had never seen this lichen before nor after this time." "During the siege of Herat (which is about 876 feet above the sea), more recently, the papers mentioned a hail of *manna* which fell upon the city, and served as food for the inhabitants." "A rain of manna occurred, April 1846, in the district of Jenischehir, and formed a layer three or four inches in thickness. It was of a greyish white colour, rather hard, and irregular in form, inodorous and insipid."

"Pallas observed it in the mountainous, arid, and calcareous portion of the great desert of Tartary. M. Eversham collected it in the steppe of the Kirghiz, to the north of the Caspian Sea, where it is called semljenoi-chleb. M. Ledebour has observed it in the same countries, but chiefly those which border on Altai and Bilezikdgi; saw it also in Anatolia, in 1845. Dr. Leveillé gathered it in Crimea, and Dr. Guyon recently in Algeria."

"It is found in irregular shaped bodies, varying in size from that of a pin's head to a pea or small nut; and when seen in its proper sites has never been found attached to any support whatever. An analysis of the Lecanora shews that there is no fecula in its composition."

Wellsted, p. 49, "learned from a Jewish Rabbi, that, on his journey

* Relat. d'un Voy. en Orient, vol. ii. p. 319.

through the desert contiguous to Damascus, far removed from any trees or vegetation of any kind, a substance was deposited, which, from his description, in appearance, size, and flavour, accurately resembled the manna of the Scriptures. Similar testimony was derived from several Bedouins."

It may be remarked, in passing, that several writers have not hesitated to identify some of these species with the manna miraculously supplied to the Israelites in the wilderness. They were obviously acquainted with manna of some kind, from the fact that they named the new substance from its resemblance to it.—*American Journal of Science and Arts; Jameson's Journal*, No. 85.

LOTUS OF THE ANCIENTS.

In a list of African plants, enumerated by Mr. Munby, is the *Nitraria tridentata* of Desfontaines, brought from the desert of Soussa near Tunis. He conjectures this to be the true Lotus tree of the ancients. It is called Damouch by the Arabs, who are aware of the semi-intoxicating qualities of its berry, much more likely to give rise to the fame of the Lotus, than the dry and unpleasant fruit of the *Zizyphus Lotus*, or that of the *Celtis australis*, to which the infatuating food of the Lotophagi has been in turn referred. The locality of the Nitraria would also agree well with the realm of the famous Lotus tree.—*Annals of Natural History.*

GROWING PLANTS IN CLOSE CASES.

Mr. Ward has made a communication on this subject to the British Association. His object was to give the results of a long experience of his plan, as well as to point out some errors with regard to the use of these cases. Time had enabled him to mature his plan, and to try it with every form of plant; and he might say that, whether for transportation from one climate to another, or for growing plants under circumstances where they could not be exposed to the atmosphere, it was perfectly successful. Palms had been transported from the tropics in these cases; and roses had blossomed in them exposed to a southern aspect in London. In order to secure the proper growth of plants in these cases, they should have moisture, be planted properly in soil, and exposed to the light. If these conditions were not attended to, the cases would fail. Sometimes, in voyages, they were covered over with boards or tarpauling, and the plants, not having light, were of course destroyed. Mr. Ward read some letters, showing that this plan of growing plants in closed cases might be made to contribute to the comforts of the poor in large towns, as the cases may be made at a small expense, and supplied with plants all the year round. He also called attention to the fact that all the lower marine Algæ might be grown in these cases by means of salt water artificially prepared.

Dr. Daubeny stated, that he had performed various experiments on the growth of plants in cases; and had found, in many cases, that plants gave out a larger quantity of oxygen gas in his cases than could be got rid of by the imperfect means of ventilation adopted. It appeared desirable not to exclude a free admission of air, so that the plants may obtain carbonic acid and get rid of the oxygen from the cases.

Geology.

BARON VON BUCH ON GLACIERS.

The learned Baron, in his description of Bear Island, in the *Quarterly Journal of the Geological Society*, says: I think I may now well venture on this conclusion, deduced from nature and experience, without needing to fear uncalled-for, verbose, and therefore unmeaning, opposition, since the regular doctrines of Venetz and Charpentier, regarding the Origin and Progress of Glaciers, are only heard in the far distance; and since the general conviction that Agassiz's unsuccessful attempt to live three summers on a glacier, and all the care and labour expended there, have led to no other result than to confirm still more the wise considerations and deductions of Saussure; and to prove that the faculty of extended generalization, which depends on few but sure observations, leads sooner and more directly to the truth than all the instruments we may heap together, without using them with proper precautions. Even the echo, still faintly repeated from the other side of the Atlantic, will in a short time cease. When we question the maps of the Swiss Alps, the mountains in the Tyrol, the Norwegian glaciers, the few seen in the Pyrenees, the magnificent vicinity of the sources of the Ganges and Jumna,—everywhere the same law appears, namely, "That glaciers only form on mountains that rise above the limits of perpetual snow, and spread out in this region; the origin of such glaciers must be sought in depressions,—wide basins of snow. They never originate on the open rocks far from large masses of snow. From these wide pots of snow, the icy mass proceeds down in deep valleys, perhaps even to inhabited places, where the temperature of the air sets limits to its farther progress, and where the portion destroyed by melting must be continually and rapidly renewed from above."

From these essential conditions in the formation of glaciers, therefore, it evidently results, *that the cause of their progress and sliding down into the valleys must be sought, either altogether, or at least chiefly, towards their origin, and above the snow-line,* never in the ice masses themselves, which in this respect are altogether passive. In this upper region, the pressure of the connected ice masses operates exactly as the pressure on the Rossberg has pushed down a whole stratum of the mountain, destroyed it, and covered half a canton with the giant fragments; and this pressure is not destroyed in its progress, but increased until the temperature and smaller declination of the valley are able to counterbalance the pressure of the mass. No glacier continues to move when the bottom of the valley on which it rests has a less inclination than 3° (Elie de Beaumont). No doubt, large extended masses of snow often appear in confined valleys below the snow-line; they may be even changed into vaults of ice, as is so beautifully seen in the ice-chapel not far from the Bartholomæus lake at Berchtesgad; only these never move; they fill no valley like a long ribbon, like a frozen cataract,—for they want *the pressure from above,* the only thing that can move them downwards into the valley.

MOVEMENT OF GLACIERS.

Sir T. D. Acland has communicated to the British Association, a Memoir, "On some Remarkable Movements of the Glaciers under the side of the Orteles-Berg." The author stated that during a visit to the Tyrol in 1819, he had heard that the Glaciers of the Orteles Mountain had advanced considerably in the preceding years, which induced him to make a personal examination of the circumstances. He found that in the spring of 1815, the Kings or Gampen Glacier had extended beyond its usual limit, and in the course of two years, advanced a distance of two English miles along the Sulden Valley, covering the meadow-land and nearly reaching the buildings of the Gampenhof. In this state, it was seen and sketched by Sir T. Acland, who again visited it in 1846, and made fresh inquiries. From 1817 to 1823, the glacier had occupied the Sulden Valley; but between 1823 and 1825, it melted away until it occupied only its original extent. In April 1845, it again advanced, and by September 1846 had travelled a distance of two thousand yards. Below this point, the Valley, nearly as far as the Gampenhof, resembled the bed of a wide torrent, being covered with moraines and blocks of stone, some of them nine or ten feet high: all the soil had been swept away by the former advance of the glacier, whose path was marked by a sterility which countless ages would scarcely remove. Previous to its unusual advance, the surface of the glacier was sufficiently level to allow of walking over it easily; but since the movement it had risen up and split into masses and pinnacles, the cracking of the ice producing reports audible at great distances.

Prof. J. Forbes pointed out that the real amount of motion in a glacier could not be estimated by noticing the point at which it terminated, since the melting of the ice might waste the glacier nearly as fast as it advanced; therefore, the movement as recorded was to be considered as the real movement minus the waste by liquefaction, which would be very great in the bottom of a deep and hot valley. Prof. Forbes then mentioned an instance of a glacier on the south side of Mount Blanc, which advanced, in 1818, until it arrived at a steep barrier against which it rose till it reached a height of 300 feet above the valley, and by its pressure against the solid rock rendered necessary the removal of a chapel at that elevation. When Prof. Forbes saw the place in 1842, the report seemed to him incredible, but on revisiting it last year, the glacier had again advanced two-thirds of the height it formerly attained. The advance of glaciers seemed often disproportioned to the cause—a very few degrees of diminution in the average temperature of the season producing an enormous extension of some glaciers; from which Prof. Forbes argued that without any marvellous change of climate the glaciers of the Alps might have extended to the Jura, across the plain of Switzerland. The extension of the glaciers depends chiefly on the quantity of snow which falls in the higher Alps, and by its partial melting supplies the glacier; it is the snow-water also which, penetrating the capillary fissures of the ice (when not rendered very hard and solid by intense frost) becomes the chief instrument or moving power upon which the advance of the glacier depends. A coating of snow promotes the movement of the glacier

indirectly, by keeping its temperature not far below the freezing point.—*Athenæum* No. 1028.

THE WAVE OF TRANSLATION, AND THE NORTHERN DRIFT.

A PAPER has been read to the Geological Society, "On the Wave of Translation in Connexion with the Northern Drift," by W. Whewell, D.D. In this memoir, the author, after referring to the northern drift, and the causes that had been suggested for explaining its phenomena, and stating the meaning and properties of the wave of translation, proceeded to discuss some of the results of its operation. He assumed, for this purpose, a certain quantity of material to be distributed within a given area; and showed, by simple calculation, different expressions for the amount of paroxysmal force that would be needed. He considers, however, that paroxysmal force is necessary; but that a movement, although small, will, if sudden, produce effects resembling those to be accounted for. He concluded by observing, that a wave of translation differs but little from the *débâcles* assumed by earlier geological speculators.

"THE SILURIAN SYSTEM."

SIR R. I. MURCHISON has communicated to the Geological Society, a paper, "On the Classification of the Lowest Fossiliferous Rocks of North Wales." The author explains the grounds on which he is is compelled to dissent from the recent proposal of Professor Sedgwick, made to the Geological Society; and shows that its adoption would break down the scientific meaning hitherto attached to the term "Silurian System." After several years of labour and preparation, that system was propounded in 1835, as a natural history group, which, though characterized by a community of animal forms, was separable into Upper and Lower divisions. The name Silurian having been given to the whole, that of Cambrian was subsequently applied by Prof. Sedgwick to the still lower adjacent slaty rocks of North Wales; it being then hoped and believed that, according to analogy, such lower rocks would be found to be distinguishable from the Silurian by a peculiar suite of organic remains. Researches, however, having now proved that the so-called Cambrian rocks are also tenanted by the same fossils which have for many years been recognized as Lower Silurian types, and these remains having further been shown to occupy the lowest fossil-bearing strata in Russia, Sweden, Norway and America, Sir Roderick Murchison maintains that this name must be adhered to in reference to all British, as well as foreign, strata which are occupied by the fossils originally described by him as Lower Silurian. In conclusion, Sir R. Murchison points out that if, in this instance, the principle of strata identified by their fossils be departed from, by merging his well-known Lower Silurian type in a name applied to a group of rocks which has never yet been described as containing fossils of its own, the very term Silurian would be excluded from the geological maps of various regions of Europe and America, on which it has been inserted after much labour; and that thus deprived of their lower and larger half, the Silurian rocks would be reduced, in many

tracts, to a small and insignificant band, quite unworthy of being entitled a System.

THE CAMBRIAN SYSTEM.

A MEMOIR has been read to the Geological Society, by the Rev. Prof. Sedgwick, "On the Classification of the Oldest Fossiliferous Rocks of Wales." Under the words "Cambrian System," the author includes nearly all the rocks both of North and South Wales, between the western coast and the Silurian rocks as coloured in Sir R. Murchison's map. The rocks of this system are exhibited as a great succession of undulations extending in North Wales from the Menai Straits to the crest of the Berwyns, and thence to the carboniferous rocks of Shropshire. The sections through these undulating groups have been described in former communications; and in the same series were included not only the rocks upon the line above mentioned, but a great series of co-ordinate rocks thrown into similar undulations, and including the whole chain of Cader Idris and the overlying slates descending into the drainage of the Dyfi. The author first endeavoured to connect his previous sections by new details; and especially by a great flagstone group containing fucoids and a species of Lingula found on the same parallel. He then described in detail five sections in various directions across the district; in all of which, with the exception of one, the lingula bed is a common base line; and he considers that the whole series of Caernarvon and Merioneth sections are thus connected, that these beds are fossiliferous throughout, that they are of vast thickness, and that they are inferior in position to all the beds (Caradoc or Llandeilo) described in the Silurian system. Next were described two sections across South Wales, through rocks occupying a great irregular trough reposing on the old Cambrian rocks, and overlaid to the south-west by the rocks of the Silurian system. These are considered to be on the parallel of one of the upper groups of the North Welsh series; and as divided into three great groups and overlaid by a fourth group still below the Silurian rocks, and called Cambrio-Silurian; above which come in perfect succession the upper Silurian rocks. The whole Cambrian system the author thus divides into four groups; the higher of which alone, and that only in part, comes into the Carodoc or Llandeilo groups of the Silurian system. Lastly, the author discussed the question of nomenclature. He considers that the terms hitherto employed for the subdivisions of the middle and older palæozoic rocks being geographical, and these terms describing the succession in particular districts, it is impossible to use the words correctly without preserving their geographical meaning: and that if a new principle of nomenclature is to be introduced which has no reference to the physical group, it is necessary to congruity of language to introduce some corresponding change in nomenclature. He states that it is impossible to describe the ascending sections in North and South Wales in Silurian terms; since, in speaking of any members of the vast ascending group of North Wales by the name Silurian, we are defining an older work than any of those belonging to the Silurian system. The author, therefore, rejects the name "Silurian system," as applied to the older division of the Cambrian rocks, and continues the use of the term "Cambrian."

THE DILUVIAN AND MODERN EPOCHS.

Prof. Pictet, in a Memoir on this subject, in the *Bibliothèque Universelle de Genève*, considers it as very probable that the different Diluvian formations enclose a series of faunas differing little from each other; a circumstance which proves that the Diluvian and Modern Epochs have been in no way separated by an event comparable to those revolutions of the globe which, at different times, have extinguished existing species, in order to replace them by others wholly different.—(See the paper, translated in *Jameson's Journal*, No. 84.)

SLATY CLEAVAGE.

One law respecting Slaty Cleavage was announced in 1831, by Professor Sedgwick,* and is now well known: that law is, that the cleavage planes maintain their parallelism over extensive areas irrespective of the varying position of the beds which they cut through, or of the mineral character of the beds. Another law respecting slaty cleavage was detected by the author† in the progress of his tour, and is the following: viz. that the strike of the cleavage coincides with the strike of the bedding, whenever the latter continues uninterruptedly the same for a considerable distance; but when the strike of the bed is inconstant, and shifts at short intervals, then the cleavage planes hold their course right on, irrespective of the varying position of the planes of bedding; in other words, that the strike of the cleavage coincides with the prevailing strike of the beds in each district, and does not vary with the subordinate and local irregularities in the strike of the beds. Whence it follows, that the strike of cleavage in a district is more constant and regular than the strike of the beds.—*Quarterly Journal of the Geological Society*, No. 7.

ACCESSORY ELEMENTS OF PYROGENOUS ROCKS.

Independently of the silicated minerals which constitute the crystalline rocks called Pyrogenous, these rocks contain Accessory Elements, found in small quantities it is true, but which must be taken into account in the study of geological phenomena. M. Durocher's researches on this subject, (communicated to *L'Institut*, No. 709,) have led him to the following conclusions:—

Independently of the silicates, the pyrogenous rocks contain a little water, and very often small quantities of earthy carbonates, which appear to have formed part of them from the first, and not to have resulted from infiltration. Frequently also, they contain, as is already known, small quantities of phosphates, *fluorides*, sulphurets, and arseneosulphurets.

The magnetic property is much more common in these rocks than is

* Geol. Trans., 2d series, vol. iii., p. 68.

† While the author was drawing this conclusion from his observations in Wales, a nearly similar law was announced to the British Association at Cork, by Professor Phillips, in the following terms:—"The cleavage planes of the slate rocks of North Wales are always parallel to the main direction of the great anticlinal axis, but are not affected by the small undulations or contortions of these lines. In North Wales, they maintain the same direction for fifty miles, not varying more than two or three degrees." (See Athenæum, 2d September, 1843.)

generally supposed. The granites alone are rarely magnetic. The magnetism of these rocks appears to the author to be owing to the presence of a small quantity of oxidulated iron, sometimes in titaniferous iron or magnetic pyrites. In other respects, it is remarkable that the greater part of crystalline rocks, even those which are not magnetic, yield a little oxide of iron to boiling acetic acid; when they are calcined, they almost always assume a reddish or rose tint.

M. Durocher concludes by adding that the Oligoclase, that species of felspar which was first observed in the granitic rocks of the north of Europe, is likewise found, though in smaller quantity, in those of France. He has discovered it in a syenite of the Vosges, and in numerous granites of the Alps, Pyrenees, and the west of France.— *Translated in Jameson's Journal*, No. 86.

COUNT KEYSERLING'S ZOOLOGY OF RUSSIA IN EUROPE.

Sir R. I. Murchison has exhibited to the British Association, the new work, entitled "Wissenchaftliche beobachtungen auf einen reise in das Petschora-land," and explained its value in completing the acquaintance of geologists with the great north-eastern angle of Russia in Europe, which is watered by the river Petchora. The geographical and astronomical observations in this Expedition, (to a region previously known only imperfectly to the Russians through the traders in fur,) are by M. P. von Krusenstern of the Imperial Navy. The geological outline of the present work, (executed in 1843,) was communicated to Sir R. I. Murchison previous to the publication of the volumes on the "Geology of Russia and the Ural Mountains," and constitutes one of the chapters of that work; but the object of this communication was to call attention to the additions which had appeared: first, in regard to the physical and geological delineation of this wild country in two maps; and, secondly, to the numerous plates (23 in number) of the organic remains of the Silurian, Devonian, Carboniferous, Permian, and Jurassic systems, occurring in a hitherto unexplored region which extends over near 11 degrees of latitude; viz., from 60° to 71° N. latitude, and 25° longitude, including the northernmost range of the Ural Mountains. Sir R. I. Murchison stated that although the eastern flank of that chain had been touched upon at one or two points by the authors, and notably in N. latitude 65°, enough had only just been done by them in this respect to connect, in an approximate manner, the structure of the northern end of the chain with that previously described: all this rocky territory, extending 3° and 4° of latitude beyond the limits of arboreal vegetation, is now under the survey of a distinct expedition, commanded by Colonel Hoffman, and sent out under the auspices of the Geological Society of St. Petersburgh. The chief geological interest attached to the work of Count Keyserling, (in addition to the points alluded to,) is the determination of an axis of palæozoic rocks constituting the Timan Ridge, which, branching off from near the Ural Mountains in lat. N. 62°, trends in a N.N.W. direction on the left bank of the Petchora to the bay of Tcheskaya, and is prolonged into the promontory of Kanin-Nos in lat. 68° 45′. This ridge, divergent from the meridian direction of the Ural Mountains, but parallel to their northern

extremity, seems to form a part of the great girdle of palæozoic deposits which wrap round the crystalline nucleus of Lapland and Scandinavia, of which the Baron Leopold von Buch, by his description of the fossils collected there, has recently determined an important fragment of carboniferous age in Bear Island near Spitzbergen, on the north-western flank of Scandinavia.—*Athenæum*, No. 1028.

MAP OF SWEDEN.

Count Rosen has exhibited to the British Association, Maps of a part of Sweden, executed by the Crown Prince, which were described by Sir R. I. Murchison. The first of these maps represented by a scale of colours the physical features of the country; a dark-green tint being employed to designate all the parts elevated less than 100 feet above the sea, and various other colours for heights up to 3000 feet. The second map exhibited the extent of the wooded district, dark green being employed for the primitive forests, and a lighter shade for those where the large timber had been felled. The third map exhibited the mining districts, dots of colour indicating the mines, whilst the routes by which the ore was conveyed to the blast-furnaces and manufactories, and to the ports (principally Stockholm and Göttenburg), were represented by lines of the same colour. The ore, being smelted by charcoal fires, has to be shipped to the forest district and again brought back; whilst the abundance of streams has given rise to numerous *hammer-works* instead of the more powerful machine by which iron is rolled in this country. The iron of Sweden has of ten travelled 1,200 miles, at a cost of 20 per cent. on its value, before it is exported. Railroads and canals will shorten the distance and lessen the expenses, whilst the restrictions on the trade are at the same time being removed. Between Stockholm and Göttenburg there is an elevation exceeding 400 feet, and the railroad now in progress will reduce the journey from 4½ days, the present time by sea, to 16 hours. Count Rosen also exhibited several other maps, one of them (by Colonel Löven) showing, by colours, the amount of population in different districts, varying from 500 to 15,000 per square mile; and the Count pointed out the relation of these colours to the physical condition of the country.

COLOURED GEOLOGICAL MAPS.

A paper has been read to the British Association, "On a System of Colouring Geological Maps," by J. W. Salter. Hitherto, geologists have represented the British strata by colours taken from the general hue of the rock, modified by the necessity of using bright tints, and distinguishing adjacent formations by colours strongly contrasted. Continental geologists have not entirely adopted these colours, nor is there perfect accordance even in the maps of Englishmen. Mr. Salter proposes to remedy the inconvenience and uncertainty attending the present mode of colouring maps by introducing a system capable of universal adoption. The same colour, he says, should always be employed for the same group of rocks, various shades of that common colour being sufficient to distinguish, and at the same time combine, all the subdivisions of that group. Again, the colours used to distinguish systems of strata should follow in some constant order. The chromatic scale naturally suggested itself as

the most harmonious gradation of colours, and accordingly Mr. Salter proposes to represent the Silurian strata by *Violet;* Carboniferous, *Blue;* Triassic, *Green;* Oolitic, *Yellow;* Cretaceous, *Orange;* Tertiary, *Red.* It is necessary to use a more intense red, with the addition of various markings, for the granitic rocks.

Mr. Greenough referred to the pamphlet accompanying his geological Map of England, for an exposition of the principles by which he was guided,—which were approved of by the English geologists, and from which the French had departed with regret. Mr. Phillips and Sir H. De la Beche recommended the adoption of one colour for each system, employing engraved lines of various kinds to distinguish the subdivisions, thereby diminishing the cost and increasing the accuracy of coloured maps. Sir R. I. Murchison said he had once attempted to apply the scheme now adopted by Mr. Salter, but found it, practically, less serviceable than Mr. Greenough's, which was the basis of all the other maps.—*Athenæum*, No. 1028.

THE AUCKLAND ISLES AND FORMOSA.

Sir R. I. Murchison has read to the British Association, an account, by Colonel Colquhoun, of the Auckland Isles, 10° south of New Zealand; which will soon be colonized, and made the centre of the great southern whale fishery*. The soil, which is derived from the decomposition of basaltic rocks, is said to be fertile; the islands are well wooded, and the anchorages good. Its only present inhabitants are ten or twelve sea birds and some rats.

Sir R. I. Murchison has also read a letter from Lieutenant Gordon, R.N., "On the Coal of Formosa." He describes the quantity as large, and its quality good.

* The exclusive possession of these Islands has been granted by Her Majesty's Government to those truly enterprising merchants, the Messrs. Enderby, by whose vessels they were discovered; and it is the intention of those gentlemen to form a company for the purpose of carrying on from thence the southern whale-fishery. "In a national point of view, (says Sir J. C. Ross,) whether as regards our maritime or commercial ascendancy, an undertaking of this nature cannot fail to be of very great importance. Its successful accomplishment would prove the means of effectually restoring a profitable but decayed branch of our maritime trade, and of diverting a large number of our most efficient seamen from the vessels of the United States of America, in which they are now employed. In the whole range of the vast Southern Ocean, no spot could be found combining so completely the essential requisites for a fixed whaling station. Possessing in themselves the great natural advantages of commodious harbours, a plentiful supply of good water and wood, with a superficies of about one hundred thousand acres, and lying in the vicinity of the Australian and New Zealand colonies, these islands present the greatest facilities for carrying on the southern fisheries on the extensive scale which the Messrs. Enderby contemplate. They are, moreover, situate, as it were, in the heart of the fishery, and in the track of ships returning to England from the Australian and Van Diemen's Land settlements. They are also conveniently placed in a more general point of view, since every vessel in the Pacific must proceed to the southward beyond their latitude, before doubling Cape Horn, on their passage to England or America. This project is not a recent one on the part of the Messrs. Enderby, but was formed by them nearly three years ago, immediately upon the return of our expedition, contingently upon the islands being granted to them by the Government; and I most cordially wish them the success their spirited conduct so well deserves."—*Sir J. C. Ross' Account of his Voyage to the Antarctic Continent.*

GEOLOGY OF AUSTRALIA.

Mr. J. B. Jukes has read to the British Association, some "Notes on the Geology of the Coasts of Australia." In this memoir, Mr. Jukés endeavours to present a general view of the physical structure of Australia. The eastern coast is occupied by a great range of high land, appearing like a continuous chain of mountains when seen from the sea, and rising in several places to 5000 feet or more above the sea level. This chain has an axis of granite, with occasional large masses of green-stone, basalt, and other igneous rocks. It is flanked on both sides by thick beds of palæozoic formations, chiefly sandstone, but also containing limestone and coal. In the northern portion of the chain, Dr. Leichardt found similar formations, and especially trap and granite near the Burdekin river. In the Port Philip district, there are similar igneous rocks, and on the coast tertiary formations which Mr. Jukes found resting on the edges of upturned palæozoic beds. In West Australia, the Darling range consists of granite below, covered by metamorphic rocks; and between it and the sea is a plain composed of tertiary beds. In the colony of North Australia, there is a great sandstone plateau, rising about 1800 feet above the sea, and probably of palæozoic age; whilst on the immediate shore and round the Gulf of Carpentaria are beds supposed to belong to the tertiary period. Similar formations constitute the substratum of the central desert; in which Captain Sturt was compelled to turn, when halfway to the Gulf of Carpentaria, from the southern coast. Hence, Mr. Jukes conjectures that these tertiary rocks are probably continuous through the whole centre of the island; and that during the tertiary period all this portion of the country was submerged, whilst the high lands on the coast rose like four groups of islands from the shallow sea. In confirmation of this view, he remarked that a greater difference existed between the plants and animals of New South Wales and Western Australia, though in the same latitude, than between those at the southern and northern extremities of the eastern chain of mountains, distant 20° of latitude from each other.—*Athenæum*, No. 1048.

COPPER MINES OF AUSTRALIA.

These Mines are, upon a special survey of 20,000 acres distance, about ninety-six miles from Adelaide. This survey was taken in consequence of large masses of copper ore which were discovered upon the extremities of the survey. The proprietors of this survey have secured to themselves the full extent of mineral land, inasmuch as the lodes run longitudinally through the survey. This has been proved by the workings which have been carried on; more especially in the northern half, where the principal lode shows a course of north about 35 degrees west. The general and almost unparalleled richness, as well as extent, of this mineral property is partly proved by the fact, that during the first year's operations 7,200 tons of ore were extracted. Some portions of these, being the first shipments, have already been sold in the Swansea market, and realized from £10. 16*s.* to £31. 3*s.* per ton. As these, however, were principally surface ores, and as there existed, during the first year, no available means for their due preparation, such as cleaning and classifying

for exportation, the average return has proved more favourable than was expected. Late accounts from Swansea state that the Burra ores are in great favour, in consequence of their great docility in the process of smelting. From the assays which have been made of the generality of ore, the quality has varied considerably; and since the shipment of surface ores, had been from 25 to 80. Red oxides, grey ore, blue and green carbonates, and malachite, are the different descriptions of ore which have been extracted; and some specimens of native copper have recently been found. As the workings in the southern half have not been formally carried on to the same extent as in the northern half, the amount of extraction has not yet been very considerable. All experienced miners who have visited this district conclude that, judging from the surface indications, which are very numerous, and the many east and west branches which join the main lode—some of which are from one to two feet and upwards wide, and contain copper ore, which, if well cleaned, would be a good marketable article—this district is the richest that has yet been discovered, and will eventually prove as valuable as the Burra, or Monster Mine.—*South Australian Register.* See *Year-book of Facts*, 1847, p. 270.

GOLD IN AUSTRALIA.

Sir R. I. Murchison, in a letter to Sir C. Lemon, on the Silurian Rocks in Cornwall, says:—"If gold exist not, (in any appreciable quantity at least,) in your otherwise richly endowed mineral county, there are, I am happy to say, good grounds for hope, that in their most distant colony Englishmen may find it abundantly. In an address to the Royal Geographical Society, delivered in May 1845, when commenting upon the valuable labours of Count Strzelecki in deciphering the structure of the great N. and S. chain which ranges along the eastern shores of Australia, I specially insisted upon its striking resemblances to the Ural Mountains, whether in direction, in structure, or in alluvia; remarking, by the way, that *as yet* no gold has been found in this alluvium. I now learn, however, that fine specimens of gold have been found on the western flank of the Australian cordillera, particularly at the settlement of Bathurst, where it occurs in fragments composed of the same matrix, (viz. quartz rock) as in the Ural. My friend and associate in the Imperial Academy of Petersburg, Colonel Helmerson, has recently suggested, that a careful search for gold ore in the Australian detritus will, it is highly probable, lead to its detection in abundance; since the Russians had long colonized the Ural Mountains, and had for many years worked mines of magnetic iron and copper in solid rocks, before the neglected shingle, gravel, and sand, on the slopes of their hills and in their valleys, were found to be auriferous. If, then, in the course of your statistical inquiries, you may know of any good Cornish miner about to seek his fortune in Australia, be pleased to tell him to apply his knowledge of the mode of extracting tin ore from his own gravel to the drift and debris on the flanks of the great north and south chains of Australia, or any smaller parallel ridges of that great country;* for great would be my pleasure to learn, that

* The grand, rich, and well-watered region which lies between Moreton Bay on the south and the Gulf of Carpentaria on the north, is that to which I

through the application of Cornish skill, such a region should be converted into a British 'El Dorado.'"

NECESSITY OF MINING EDUCATION.

Mr. W. W. Smyth, M.A., Mining Geologist to the Geological Survey of the United Kingdom, in a paper detailing the system pursued at the Mining Academies of Saxony and Hungary, observes:—

"Looking at the class of men who, in this kingdom, are intrusted with the direction of collieries and mines, we find them, in general, characterised by a remarkable degree of energy and intelligence; and yet it cannot be denied that, independently of the losses entailed by the uncertainty of mineral veins, large sums are yearly squandered on ill-judged, and sometimes, even absurd, speculations, which a greater amount of experience on the part of the proposer would have taught him to modify or abandon. We cannot be surprised to hear of similar failures, when we consider, first, the comparatively short time over which a single man can extend his experiences; secondly, the great amount of phenomena which must be observed and compared to form a ground-work for practical geology; and, thirdly, the numerous branches of other arts and sciences, some of which should properly precede its study; whilst others, immediately connected with the duties of the mining agent, intervene to distract his attraction, and render it difficult for him to attain a great degree of proficiency in any one particular subject.

"The course of mining education fails in one of its most important features, the inculcation of the general principles and the practical application of geology; and it need excite no surprise that serious blunders should often be committed, even in a country where such errors might be checked by the existence of an institution like the above; and, as too frequently happens nearer home, that coal should be absurdly sought in non-carboniferous geological formations, where a few black shales attract the attention of the ignorant speculator."

DEPRESSIONS IN THE LAND NEAR POZZUOLI.

Mr. J. Smith has detailed to the British Association, the result of careful measurements of the sea-level above the pavement of the famous Temple of Serapis, near Pozzuoli. These measurements, made independently in the years 1819, 1826, 1838, 1843, and 1845, by Mr. Smith, Prof. Forbes, and the Chevalier Nicollini, all conspire to prove a gentle subsidence of the land on which the temple stands at a rate of about one inch annually. Mr. Smith gives other proofs of the encroachments of

would specially direct attention, now that its true characters have been opened out to geographers and naturalists by the undaunted and able explorations of Dr. Leichhardt. Some of the tracts recently passed through with so much zeal, by the Surveyor-General of the colony, Sir Thomas Mitchell, may also prove valuable in gold, though they lie further from the axis of elevation. In the meantime, gold ore has been found on the other side of the Australian continent, in the ridges which extend northwards from Adelaide towards the scene of the adventurous and toilsome journey of Major Sturt. These gallant geographers, the pioneers of civilization, are explaining to us the condition of tracts which thousands of our countrymen may soon colonize with the best effects.—April 12, 1847.—R. I. M.

the sea from an engraving in the "Vera Antichita di Pozzuoli," published at Rome, in 1652, where the churches are represented as intervening between the three columns and the sea. These churches are washed away, as well as two sea-walls, built one within the other for the protection of the road. Mr. Smith then gives a variety of proofs, historical and geological, of the subsidence of parts of the coast of Normandy, Brittany, and the Channel Islands. The stumps of trees are seen standing in the sea, in spots where, at high water, the sea is sixty feet deep; and Mr. Smith has ascertained, from MSS. of the ninth century in the Library of Avranches, that these forests were tranquilly submerged about that period. Mr. Smith also states, on the authority of Capt. Martin White, R.N., that on the coast of Normandy, lines, evidently artificial, and apparently stone walls, are seen under water running out to sea; and that the lead in sounding on that coast frequently brings up fragments of bricks and tiles, which he is convinced are the ruins of submerged buildings.

ELEVATION OF THE LAND AT PLYMOUTH.

We find this in evidence in the *Plymouth Herald*:—"If we land upon the N.E. point of the Mewstone, there is a bank of debris resting upon a stratum of rolled pebbles of all sizes; this raised beach being sheltered from the breakers, remains as an evidence of a change of the relative levels of the Mewstone and sea having taken place. Passing from the Mewstone to the main land, and coasting round the Sound, we find a succession of these beaches in the cliffs, about 15 or 20 feet above high-water mark; they may be seen at Bovisand, under the Hoe, near Redding Point and Cawsand. But we have other evidence of elevations,—submarine limestone rocks are everywhere perforated and honeycombed by *Pholades*. About low-water mark and downwards, they are everywhere found alive, but higher up we find them dead; and as high as high-water mark their cells may in some localities be seen. These animals can only live below the mean level, requiring to be altogether under water, or at least covered by every tide. Now, when we find the empty cells of these creatures in the solid limestone rocks under the citadel, but at such a height as would preclude the animals from living in them, we can only infer that the rocks have been raised, or that the sea level has been depressed. Many of these cells may be seen in our locality. The writer had occasion to land a few days ago near the Blockhouse, and directly under the battery at Devil's Point; here he observed that there had been a fissure in the limestone, and a portion of the rock had been removed, leaving a vertical surface of the solid limestone exposed to view. This part of the rock is covered with the cells of the *Saxicava rugosa*, and above the ordinary high-water level, thereby leaving proof that our shores have been rising slowly and imperceptibly; the place is easily accessible, and anybody may see the place referred to. If the land be rising still, harbours will become more shallow; the system now pursued of observing and recording tides and soundings will settle the point."

SUBSIDENCE OF SCANDINAVIA.

Prof. Nillson has read to the British Association, a paper "On the Elevation and Depression of the Surface of Scandinavia." The Subsidence of the extreme southern part of Sweden in comparatively recent times is indicated by the occurrence of peat-bogs in Scania, from 14 to 20 feet below the level of the Baltic; yet containing human skeletons and weapons, associated with the bones of the *Aurochs* and other existing animals. Further north, instead of the land subsiding, it has long been rising higher from the sea; raised beaches, and terraces of gravel containing sea-shells and human skulls, of Celtic races, have been for some time well known.

Mr. Phillips considered these evidences of the gradual elevation of one portion of Sweden, attended with the equally gradual subsidence of another, as amongst the most valuable aids to the interpretation of ancient phenomena; for although there was no evidence that our own coast was now undergoing similar changes, yet the cause was not extinct in nature, which had produced such changes here, in more ancient times.

Prof. Sedgwick adverted to the well-known fact of the organic remains of marine animals being found in situations far removed from the sea, and at great elevations, "even to the bristling crests of the Alps and Andes;" these facts were admitted in proof of the elevation of the land —not of the subsidence of the sea. The instructive phenomena still witnessed in Sweden were not, however, to be taken as a *measure* of the forces employed by nature in all parts of the world and in all time;—such gradual movements might continue for a long period, producing a dome-shaped elevation of a portion of the earth's crust, but whenever the expansive force below overcame the tension of the upheaved strata, a succession of catastrophes might follow, totally unlike the slow changes which preceded; the broken strata might be contorted, or displaced hundreds of fathoms, and movements produced in the ocean itself, effecting greater changes on the coasts than a million years of gradual erosion.

RISE IN THE SOIL OF EGYPT.

During the course of the cadastral operations lately ordered by Mehemet Ali, it was shown that the Soil of Egypt is rising each year very perceptibly, in consequence of the continued deposit left by the Nile. This elevation is calculated at 30 feet during the last century for the provinces adjoining the river.—*Galignani.*

RISE OF THE THAMES.

A correspondent of *The Builder* notes: "I have noticed for nearly half a century the gradual and regular Rise of the Waters of the River Thames. My attention was first drawn to it by finding that extreme high tides were not preceded, nor succeeded, by similar tides. These were recorded by the watermen of the Westminster Horseferry, by notches cut by them on a post there, ere the post was removed when the street was raised. I now observe, that professional men, in reporting on some localities, such as Westminster, say that the sewers were originally too low. But it appears that the said sewers were high enough when they were

first made; but are not so now, owing to the rise of the river. It appears that I am the first person who has noticed a circumstance so universally continuously evident. The architects of modern as well as ancient buildings were not aware of it, as will be too plainly seen by referring to the floor of Westminster Hall, the upper line of the starlings of old London-bridge, the gate of Lambeth Palace, the York water-gate, Adelphi, the level of the wharfs there, &c. The ground-line or plinth of the palatial Houses of Parliament is already below the level of extreme high tides. The difference of the rise of the highest tides before the Parliament Houses were burnt down, to the last highest tide, viz. in December, 1845, is but ten inches. The preceding highest tide was in October, 1841. These two tides were very carefully noticed at the 'Fox under the Hill,' Adelphi,—the people there being up at the late hours both these tides occurred at—the difference was exactly one inch; the lines of elevation are painted in the tap-room there."

THE LONDON CLAY AND RED CRAG.

The Rev. J. S. Henslow has read to the British Association, a paper "On Detritus derived from the London Clay, and deposited in the Red Crag." The author refers to a former notice of concretions found in the red crag at Felixstow, on the Suffolk coast, which he had considered of coprolitic origin, and of the same age with the crag. Mr. J. Brown, of Stanway, had subsequently published an analysis of these bodies in the *London Geological Journal*, and attributed them to the wreck of the London clay. Mr. Henslow now acknowledged the correctness of Mr. Brown's view, which had been confirmed by the discovery of vast quantities of similar nodules in beds of London clay, exposed by railway cuttings near Colchester. He had also been led to the same conclusion with regard to the ear-bones of the whale, fishes' teeth, and other highly mineralized fossils found with the nodules;—a conclusion adopted by Prof. Owen in his work on British Fossil Mammalia. Both the bones and nodules were often covered with vermicular markings, similar to those on flint beach pebbles, which he attributed to the dendritic arrangement of some of the mineral constituents of the mass, and not to the presence of spongeous or fucoidal tissues. Mr. Henslow also called the attention of the meeting to a recent occurrence near Stow-market, in Suffolk:—a railway embankment, twelve feet high, had been made, but vanished in the course of a night, leaving a pool of water fourteen feet deep; and on boring it was found that a bed of peat existed below to the depth of eighty feet. A well had lately been sunk near the same place, and at the depth of seventy feet a bed of shingle was found, with seashells unchanged in composition and colour, and identical with species still common on the sea-shore of Suffolk. Both these circumstances rendered possible the tradition that Stowmarket was a port in ancient times, and that the stone, of which one of the churches is built, was brought by sea.

ANCIENT SEA-MARGINS.

Mr. Robert Chambers has communicated to the British Association,

an elaborate essay on Ancient Sea-margins; broaching the theory that the gravel strata found at various elevations throughout the British Isles, in America, and elsewhere, were the beaches of ancient seas, from which the waters had subsided. He assumed one of these at St. Andrew's in Scotland as his basis; and, from a multitude of corresponding examples of terraces of the same kind, copiously and beautifully illustrated by drawings, supported his hypothesis in a very ingenious and able manner. It did not, however, find favour in the sight of the leading geologists; and Mr. Phillips, Mr. Lyell, Sir H. De la Beche, and Dr. Buckland, severally attacked it as not sufficiently matured for generalization. They held that the elevation of the land, from various causes, was a more feasible explanation of the phenomena.

Mr. Darwin referred to the prairies of North America and the great plains of Patagonia and the Pampas of South America, in support of Mr. Chambers's view of the occasional uniform elevation of large tracts of land. The raised beaches in the Andes occurred at irregular intervals to a height exceeding 500 feet, and maintained a uniform level for great distances. Mr. Chambers, in reply, stated that he had necessarily omitted a great portion of the details in his paper, which would have explained or supported the particular cases, and had thrown out his general views to invite discussion and further inquiry.

PALÆOZOIC FORMATIONS OF NEW SOUTH WALES AND VAN DIEMEN'S LAND.

Mr. Jukes has read to the British Association, a memoir on this phenomenon. The author began by stating that the county of Cumberland, in which Sydney is situated, is composed of palæozoic rocks of great thickness; and he described, in detail, a section from Liverpool, at the level of the tidal waters of the George's River, to Wollagong, a distance of 38 miles to the south. The strata, which are greatly inclined and repose conformably on each other, are as follows, in descending order:—1. Black and brown slabs, containing fragments of vegetable matter and fishes (?), at least 300 feet thick. 2. White and yellow sandstones, containing no fossils: of great thickness, not less than 700 or 800 feet thick. 3. Alternating slabs and sandstones, 400 feet thick. 4. Coal measures, with thin seams of coal, 200 feet thick. 5. Compact sandstones, with calcareous concretions; containing *Stenopora crinita*, *Producta rugata*, three species of Spirifer, Orthonota, N.S, Pleurotomania, and Bellerophon, N.S., &c. The author expresses his belief that there are newer, as there are certainly older, beds in the vicinity than these last mentioned sandstones. The author next described the east and south-east of Tasmania; consisting of horizontal beds of sandstone, with subordinate beds of limestone and slate, of a thickness of 2,500 feet at least; abutting against, if not capped by, a mass of columnar greenstone, which rises 1,700 feet above the sandstones. The limestone contains fossils of palæozoic forms; some of them specifically identical with those of Wollagong. Lastly, the author mentioned the occurrence of two patches of tertiary limestone, containing a Helix, a Bulimus, and leaves.

THE FRESHWATER EOCENE BEDS OF THE HORDLE CLIFFS, HANTS.

The Marchioness of Hastings has communicated to the British Association, a Memoir on this phenomenon, which is thus reported in *The Athenæum*, No. 1027.

The Cliffs at Hordle, on the coast opposite Alum Bay in the Isle of Wight, exhibit two beds of White Sand, in each of which remains of the *Palæotherium* have been found. They both dip to the east and are seen for a distance of about 60 yards; the lower bed consists of sand mixed with marl, the other is 15 feet higher, and only from 6 to 12 inches in thickness. For some distance, the sand of the upper bed is peculiarly fine and pure: it contains shells of *Planorbis* and *Limneus*, fish-scales and fruit of the *Chara;* the bed then increases in thickness, and contains indurated masses of sand and shells (*Potamides*) incrusting the remains of *Palæotherium* and other extinct Pachyderms, fishes, tortoises, and crocodiles. In this position were found the upper jaw, skull, and a few other bones of the *Paloplotherium*, (Owen)—a new species of extinct Pachyderm; and within three feet of it was the cranium and other bones of a large crocodile. The collocation of these remains and the condition of the mammalian bones suggest the idea that the crocodile had preyed on the quadruped. At the same spot was found the jaw of the offspring of the crocodile, so small as to warrant the supposition that it was entombed when barely ushered into existence. Besides these, in a portion of the stratum only six feet wide and ten inches thick, were obtained the nearly entire shell of a freshwater tortoise (*Trionyx*) and scales of a fish allied to the bony pike (*Lepidosteus*). At the distance of twenty or thirty feet, the upper jaw and head of a smaller crocodile were disinterred, in perfect preservation. From the nature of the matrix, these fossils are extremly brittle, and are sometimes taken out in numerous fragments, but so sharp and perfect as to be capable of complete re-adjustment. Eight years since, Lady Hastings discovered a corresponding stratum between Cowes and Colwell Bay; containing scales and teeth of the crocodile, the shell of the *Trionyx*, the palate of the *Pristis Hastingsii* (Ag.), and the bone of a Lophiodon or Palæotherium, described by Mr. Owen. The association at one spot of so many bones of the same animal indicates the tranquil nature of the deposit; whilst the perfect preservation of the remains shows that they have not been subject to violent disturbances at subsequent periods, and the occurrence of the same bed and the same fossils on each side of the Solent sea points out the extent of the lake or river-channel where the creatures lived and died. The fossils exhibited by Lady Hastings consisted of two remarkably perfect fossil skulls of an extinct species of crocodile, and the singularly complete carapace of a freshwater tortoise (*Trionyx*), in which all the requisite characters for determining their nature and affinities could be studied with the same facility as in recent specimens.

Professor Owen pointed out that the crocodilian jaws from Hordle were distinguished from those of the recent Gavials and ancient Teleosaurus by their breadth, strength, and comparative shortness; and equally distinguished from the recent alligators by the large canine teeth of the lower jaw, which rest on grooves or notches in the outer margin of the upper

jaw, when the mouth is closed; and also by the festooned contour of the alveolar border of the upper jaw. The Hordle crocodile was, however, specifically distinct from all the recent crocodiles, and differed from the fossil crocodile of Sheppy in the greater breadth of its muzzle and the strong festooning of the border of the upper jaw, approaching more nearly the crocodile of the Indian continent. Professor Owen proposed to name the Hordle species *Crocodilius Hastingsii*.

TERTIARIES OF THE ISLAND OF COS.

Prof. Edward Forbes observes that these fossils present phenomena of striking interest and importance, as bearing on the question of the possibility of a transmutation of species. The Professor considers these two facts, *first*, of the nature and causes of the variations among such testacea as present such curious changes of form in the Cos freshwater beds; and, *secondly*, of the necessity of a change of ground for the well-being of a species, and the manner in which, owing to the nature of the larva, such change may be effected on the same spot, have led him to propose the following solution of the Cos problem.

The lowest series of horizons was deposited in the basin when it was purely a freshwater one, and in it we found the *Paludinæ*, &c., in their normal condition, associated with ordinary freshwater molusca. These latter are killed off by an influx of salt water, sufficient to render the basin slightly brackish. This influx takes place at a time when the molusca of the uppermost horizon in the lowest series have exhausted their ground; whilst, at the same time, their fry are swimming in the manner of Pteropods through the waters.

The adults are destroyed, but their descendants survive, so affected, however, by the change in the condition of the element as to assume a new form, and develope themselves under the aspect of distinct species. A second revolution of the same kind brings about a third, still more remarkable, and apparently equally sudden, change, and the continued inroads of the sea at length revolutionise the character of the fauna, introduce marine testacea in the place of the freshwater species, and destroy the latter altogether. Such an explanation is consistent with what we now know of the modes of variation among freshwater molusca, and accounts sufficiently for a very remarkable palæontological phenomenon, which, at first glance, appeared to afford strong support to the notion of a transmutation of species in time.—*Travels in Lycia, by Professor Edward Forbes and Lieut. T. A. B. Spratt, R.N.*, vol. ii. p. 199.

MARINE PLANTS IN WORCESTERSHIRE.

Mr. Buckman has communicated to the British Association, a paper "On the Occurrence of Marine Plants in Worcestershire." Two seashore plants, *Glaux maritima* and *Arenaria marina*, were discovered by the author, growing on the banks of the Droitwich Canal, which is connected with the salt-works, and has a brackish taste along its whole line, from Droitwich to the Severn, three miles above Worcester: a pint of this water was recently examined, and yielded 64 grains of common salt. Mr. Buckman considers it improbable that the seeds of these plants

should have travelled by water from the Bristol Channel, or by the small barges from Gloucester; and he suggests that these species, finding the circumstances favourable, have continued to grow here ever since the Severn Valley was an estuary of the sea; or that the seeds of the plants growing here when the sea retired, remained dormant in the soil, till springs or a canal of salt water restored the conditions necessary to their development. The river, now comparatively narrow, has evidently diminished its bounds continually for many ages; and on either side of the vale are raised banks or terraces of marine gravel and sand, sometimes containing shells of Cardium and Cyprina, Littorina, Murex, Ostrea, and many other genera. But besides these undoubted sea-beaches, and the two sea-plants mentioned, numerous other plants, not strictly marine, but such as are seldom found far from the sea, occur at various places on the banks of the Severn, and also serve as traditions of the sea. The most conspicuous of these semi-marine plants, are *Apium graveolens*, *Erodium maritimum*, *Plantago maritima* (Stourport), *Scirpus maritimus*.

Prof. E. Forbes considered these observations were of interest. The problem was one which extended over all Europe. He wished also to announce a discovery made by Mr. M'Andrew: whilst dredging, in June, off the coast of Skye, he had found living specimens of a crag fossil, the *Terebratula cistellula* of Mr. Wood, associated with glacial molusca, at the depth of 30 fathoms.—*Athenæum*, No. 1029.

KENT'S CAVERN, TORQUAY.

A PAPER has been read to the Geological Society, by Mr. E. Vivian, detailing some recent researches made in this Cavern by the Torquay Natural History Society. In one place, the Committee found a layer of dark mould, containing burnt wood or charcoal, with recent shells and bones, resting on the floor of stalagmite; and below this a solid bed of red marl, full of broken bones and teeth of extinct animals. In another place, below a floor of stalagmite, which was carefully swept, and seemed never to have been disturbed, they found the same red loam, with many bones much decayed, and a flint knife. In a third place, where the stalagmite was about a foot thick, the same loam contained a bed of fossil teeth, principally of the hyæna, many fossil bones, and among them another very perfect flint knife. The author thinks that the Cave was first inhabited by bears, hyænas, and other carnivorous animals, by whom many of the bones were carried into the Cave; that these, by means of a flood, were mixed with the red loam, and that men subsequently inhabited the Cave, leaving the flint knives now found. Then came a third period, in which the stalagmite was deposited; and last of all, that period in which the British remains found above the stalagmite were deposited in the Cave.

NEWLY-DISCOVERED CAVERN IN DERBYSHIRE.

A SUBTERRANEAN Crystallized Cavern has lately been discovered by workmen employed at the limestone quarries of Thomas Gisborne, Esq., near Dovehole, about midway betwixt Chapel-en-le-Frith and Buxton. This Cavern, although not quite so large as some of the celebrated ca-

verns in Derbyshire, is little inferior to any in richness and beauty. There are two Caverns; but the first is quite inferior to the second, both in magnitude and splendour. The latter is very spacious, the sides and top being encrusted with spar and crystallizations of various sorts; and from the roof are suspended numerous stalactites of great length, which, by candlelight, give to the grotto a brilliant appearance. In a chink of the rock, at one side of the cavern, is a fossil greatly resembling the jaw-bone of some huge animal, the teeth of which appear to be perfectly entire, and as hard as adamant.—*Daily News.*

GROUND ICE.

A PAPER by Mr. Richard Adie, on Ground Ice, has been read before the Wernerian Natural History Society. In this communication, the author attempts to account for Ground Ice, without the intervention of any hypothesis which attributes the Ice found in the beds of streams to a process of formation *in situ*. The article will be found entire in No. 84 of *Jameson's Journal*. In conclusion, Mr. Adie considers, from the facts and reasonings in his paper, that the general explanation of the phenomena of Ground Ice for the climate of Great Britain will become simply this:—that it is all either formed on, or thrown in on, the surface, and made to assume an unnatural position by the mechanical action of the current.

PETRIFACTION OF SHELLS IN THE MEDITERRANEAN.

MM. MARCEL DE SERRES and L. FIGUIER state, that phenomena are now taking place in our own seas, altogether similar to those which have produced the Petrifaction of Shells. They shew that, in the double relation of chemical composition and mode of petrifaction, the shells preserved in the bottom of the sea are in every respect like those which belong to the tertiary formations. The difference which exists between the mode of substitution at present times and that of geological times, consists in this, that the petrifactions found in the historical epoch usually present a more crystalline texture. They do not, however, become very compact till they have passed through different degrees. The investigations of MM. Marcel de Serres and Figuier have related chiefly to oysters, pectens, venus, petunculi, and cardium, genera found, at the same time, preserved in tertiary formations, and in recent banks of rivers.—*Supplement à la Biblioth. Univ. de Genève; Jameson's Journal*, No. 84.

VEGETABLES CONVERTED INTO COAL.

SIR R. I. MURCHISON has read to the British Association, a statement from Dr. Göpping, that he had succeeded in converting Vegetables, in a moist state, and at a temperature of 140° to 210° Fahr., into brown Coal, or lignite, in the course of one year; and by the addition of $\frac{1}{20}$ part of sulphate of iron, to supply the place of the pyrites usually found in it, he had produced the black colour of ordinary coal.

FOSSIL PLANTS OF THE CARBONACEOUS STRATA NEAR SYDNEY.

PROF. SEDGWICK has read to the British Association, a paper on these

phenomena, in which he states, that the cliffs on the coast near Sydney, Australia, exhibit a series of strata which have been compared with the Devonian rocks of England: they dip from the north, and from the south, towards Sydney, where, in the central and newest portion of the section, beds of coal and numerous fossil plants have been found; and the carbonaceous beds are not separated from those below by want of conformity or any great change of mineral character. A large series of the fossil plants has been transmitted to the Cambridge Museum, by the Rev. W. B. Clarke, and these have been examined by Mr. M'Coy, and the results reviewed by Dr. Hooker. It appears, that out of fifteen species, ten are new, and five have been already described: with the exception of one species, all are peculiar to Australia; this one is the *Glossopteris Browniana*, of the Indian coal-fields. Of the genera, some are common to the European oolites and coal formations (*Pecopteris*, &c.); but none of the genera peculiar to the coal (such as *Stigmaria*) have been found. One most remarkable genus, *Vertebraria*, is common to the Australian and Indian strata. The whole group, and especially the genera *Gleichenites* and *Phyllotheca*, are more nearly related to the existing Flora of New Holland than the plants of any other portion of the world.

SUBSTITUTE FOR COAL.

Operations have been recently undertaken in the Valley of Torrino, a province of the Abruzzo di Teramo, for the discovery of fossil coal. The depth of the excavation is at present 240 feet; but the workmen have not succeeded in discovering the desired carboniferous strata. The combustible materials, however, hitherto discovered are of excellent quality, and contain hydrogen and carbon in abundance, with a small portion of sulphur. The comparative tests applied show that this material is not at all inferior in quality to the coal of Newcastle.—*Diario di Roma.*

FOSSIL CALAMITES.

Mr. Binney has communicated to the Literary and Philosophical Society of Manchester, a paper "On Fossil Calamites found standing in an erect position in the Carboniferous strata near Wigan, Lancashire;" the object of which communication is to show that Calamites have been found standing erect on the places in which they grew by the side of Sigillariæ; and that the rootlets of the former very much resemble, if they are not identical with, those of the latter plant. "Although," says Mr. Binney, "it will not by any means be safe to affirm that Sigillaria and Calamites are the same plant from their analogies, still it is conceived that sufficient evidence has been adduced in this paper to prove that the latter as well as the former plants have generally grown on the places where they are now found; and that the reason why one is so much more frequently found in an erect position than the other, arises from the circumstance of the stem of the one being much stronger than that of the other. A deposit of mud on the branches and leaves of the slender stem of a Calamites might weigh it down and prostrate it, whilst the stout trunk of the Sigillaria would resist such action, and continue

erect."—See the paper, with illustrations, in the *Philosophical Magazine*, No. 208.

THE AMERICAN HUMAN FOSSILS.

Touching the questionable account of the discovery in the vicinity of Natchez,* in North America, of some Human Fossils associated, under exactly the same circumstances, with the remains of extinct mammalia, Dr. Dickeson, of Natchez, who is in possession of these fossils, has written as follows to Mr. T. D. Allen, of North Cerney, Cirencester: "I shall commence with the fossil innominata. That this ancient relic of our species is strictly in the fossil state is manifest from its physical characters, in which it accords in every respect of colour, density, &c. with those of the megalonix and other associated bones. That it could not not have been drifted into the position in which it was found, is manifest from several facts: 1st. That the plateau of blue clay is not appreciably acted on by those causes that produce ravines in the superincumbent diluvial. 2d. That the human bone was found at least two feet below three associated skeletons of the megalonix, all of which, judging from the apposition of proximity of these several parts, had been quietly deposited in this locality, independently of any active current or other displacing power; and, lastly, because there was no admixture of diluvial drift with the blue clay, which latter retains its homogeneous character equally in the higher part, that furnishes the extinct quadrupeds, and its lower part, that contains the remains of man. There are fragments of the human skeleton found on the shores and islands, as well as those of extinct animals—no doubt washed out of the bluffs—and in the same fossil state. I have many such specimens in my cabinet; but with these I have not ventured at any comparative age. But the innominata found in an undisturbed locality, 70 feet from the surface, and three miles from the river banks, has established, beyond a doubt (and endorsed by the Academy of Science, Agassiz, and others), the great antiquity of this bone."—*Literary Gazette*, No. 1586.

LAKE BAIKAL.

Lake Baikal is about seven or eight hundred versts in length, and about seventy or eighty broad at its widest part. The waters are as clear as crystal, everywhere deep, and in many places unfathomable. Besides the numberless cascades that rush down its walls of mountains, it receives many rivers, more especially the Angara at its northern extremity, and the Selenga on its eastern side, towards the south; and its single outlet, in spite of the superior claims of the Selenga, on the double ground of position and magnitude, professess in its name to be a continuation of the remote and comparatively inconsiderable Angara. The two Angaras are sometimes distinguished from each other as Upper and Lower. The quantity of water which issues from the lake is believed to be vastly less than that which flows into it, the difference being, in all probability, too great to be explained by evaporation alone. In this view of the thing, a large portion, as a matter of course, must be absorbed, an operation which

* See Year-book of Facts, 1847, p. 268.

the volcanic origin of the huge hollow may be supposed likely to facilitate.—*Jameson's Journal*, No. 85.

EXTINCT DOG OF THE CANARIES.

THERE has lately been discovered, in opening a quarry at the island of Grand Canary, the skeleton of an enormous Dog, in a good state of preservation. It was purchased by the consular agent of France, and sent to the Museum of Natural History, at Paris. It is an object of the greatest interest to science; from the fact that it belongs to that enormous race of dogs which, according to Pliny, gave the name to the Canaries, and which for some centuries have disappeared from the face of the globe.—*Boston Daily Advertiser.*

NEW FOSSILS.

A PAPER has been read to the British Association, "On the *Cystidea* found in British Rocks, and on recent additions to our knowledge of the fossil *Echinodermata*," by Prof. E. Forbes. In 1843, when Mr. Morris published his Catalogue of British Fossils, the number of known *Asteriadæ* was only four, of *Ophiuridæ* five, and of the *Cystidea*, only one doubtful form. Prof. E. Forbes is now acquainted with thirty species of British fossil Asteriadæ, mostly made known through the researches of Mr. Dixon; with eleven Ophiuridæ, seventeen undoubted Cystideans, and an example of the *Euryal da*, discovered by Prof. Sedgwick, and the only fossil representative of an important existing tribe. The most curious of these new fossils are the *Cystidea*, a tribe of radiate animals, on which important light has been thrown by the researches of Baron von Buch; of these creatures four belonging to the genus *Spheronites*, three to *Caryocystites*, one allied to *Cr·ptocrinites*, and three species of *Hemic·smites*, are from lower Silurian rocks. Besides these, there are three species of *Sycocystites*, (or *Echinoccrinites*), and three *Pseudocrinites* from the upper Silurian rocks of Dudley. With the exception of four species all these Cystideans are new forms, and unknown on the Continent. Prof. Forbes then stated his view of the relations of the *Cystidea*, which he regards rather as above the *Crinoideæ* in the zoological series than below them; they combine with the *Pentremites* to form a great and rapidly metamorphosing group, diverging within itself, and conducting from the *Chrinoideæ* to the *Echinidæ* and *Asteriadæ*, by a metamorphosis at first apparently retrograde, and repeating the rudimentary forms of the Crinoids themselves. According to this view of their zoological relations, they are not to be regarded as a first sketching out of the crinoidal group in the earliest strata, those in which they most abound, but simply as modifications of echinodermal forms adapted to peculiarities in the physical condition of the bed of the sea. Of the new *Asteriadæ*, those found in the palæozoic strata bear closer affinity to the existing *Urasters* of cold and temperate climates; so also does the *Protastar*, the fossil form of *Euryale*. The oolitic and cretaceous starfishes bear a closer resemblance to species from warmer climates, the cretaceous formation containing the genera *Goniaster, Goniodiscus, Oreaster, Ophidiaster*, and *Asterias* proper. —*Athenæum*, No. 1028.

BORING MARINE ANIMALS.

Mr. W. Thompson has announced to the British Association, the discovery of species of *Teredo, Limnoria, Xylophaga,* and *Chelura,* in Ireland, all of which were found contributing to the destruction of a pier.

A discussion followed the reading of this paper, on the mode in which the Mollusca bore into wood and other materials. Prof. E. Forbes stated that some of the Gasteropodæ had tongues covered with silica to enable them to bore, and it was probably by some process of this kind that all the Mollusca bored. Mr. Peach had never observed the species of Pholas to turn round in their holes, as had been stated by some observers, although he had watched them with great attention. Mr. Charlesworth referred to the fact that, in one species of shell, not only did the hole in the rock which the animal occupied increase in size, but also the hole through which it projected its siphons.

BASALT IN KERGUELEN ISLAND.

Sir J. C. Ross, in his account of his Antarctic Expedition, states that on the south side of Christmas Harbour, in Kerguelen Island, "is the extraordinary rock noticed by Cook, and which forms so conspicuous an object in his accurate drawing of this place. It is a huge mass of basalt, much more recent than the rock on which it rests, and through which it seems to have burst in a semi-fluid state. It is upwards of five hundred feet thick, and rests upon the older rock at an elevation of six hundred feet above the level of the sea; and it was between these rocks of different ages that the fossil trees were chiefly found, and one exceeding seven feet in circumference was dug out and sent to England. Some of the pieces appeared so recent, that it was necessary to take it in your hand to be convinced of its fossil state; and it was most curious to find it in every stage, from that of charcoal, lighting and burning freely when put in the fire, to so high a degree of silicification as to scratch glass. A bed of shale, several feet in thickness, which was found overlaying some of the fossil trees, had probably prevented their carbonisation when the fluid lava poured over them. A still more extraordinary feature in the geology of this island is, the numerous seams of coal, varying in thickness from a few inches to four feet, which we found imbedded in the trap-rock; the positions of two of the larger of these seams are marked on the annexed plan. Whether the coal is in sufficient abundance ever to be of commercial importance, we had not the opportunity of ascertaining; but at the present day, when steam-vessels are traversing every portion of the ocean, it may not be unworthy a more extended examination; for in no situation would it be more desirable to have a coal depôt than at this island, lying, as it does, immediately in the high road to all our Indian and Australasian colonies, abounding with excellent harbours, and at a convenient distance from the Cape of Good Hope."

LARGE PLATES OF MICA.

The Vittim is remarkable for a Mica mine, which is said to produce the largest and clearest sheets of the substance in the world, some of them

being quite pure to the extent of two feet and a half square.—*Narrative of a Journey round the World, by Sir George Simpson.*

VOLCANOES IN THE MOON.

An inquiry on this subject has been read before the Association of American Geologists and Naturalists, by Mr. J. D. Dana, in which he refers to the vast magnitude of the Craters of the Moon, as one important feature unsatisfactorily explained. "It is not surprising," says the author, "that in view of their stupendous size, many should have been incredulous as to their crater character, and preferred to designate them by some non-committal term, as circular ridges, or ring-mountains; nor that geologists, in general, have hardly ventured to acknowledge their belief in these lunar wonders. Imagine, if possible, in place of an ordinary crater, circular areas 50 to 150 miles in diameter, and 10,000 to 20,000 feet in depth. Such are many of the lunar craters; and they are crowded in great numbers over the larger part of its surface, varying from even a more capacious magnitude, down to those that measure but a few miles in breadth. It is not astonishing that there should be found much difficulty in reconciling their features with those of Vesuvius and Etna, hitherto received too generally as the types of volcanoes and volcanic action." The crater of Kilauea in the Hawaiian Islands is of a wholly different character, and Mr. Dana presents some illustrations which, if he mistakes not, gives a full interpretation of whatever has been considered mysterious in these lunar ring-mountains.—See the paper, quoted in *Jameson's Journal*, No. 85.

VOLCANOES.

In the *Athenæum*, No. 1020, we find recorded the following copy of a written notice furnished to a Correspondent of that journal, by the principal guide up Vesuvius, and bearing date the 22d of April. "At 9 o'clock P.M., in the direction of the point of Palo, was formed a new mouth—whence have issued five currents of lava. Two flowed over the point of Palo. One has arrived at the foot of the crater of Bosso Reale, and the other two rest above the same crater. These are extinguished immediately at their birth. The great mouth, from which have issued the five currents, has begun to eject stones and fire, whilst the cone of the crater remained tranquil. This continued for an hour;—when the mouth beneath was extinguished, and the cone of the crater threw out stones of the weight of a cantaro (200 lb.) From the small mouth which had been extinguished issued four circles of different colours, and then nothing else was thrown out. At the point of Nasone on the mountain of Somma (Vesuvius) a man fell, and was found, (19th of April), dashed to pieces."

After a silence of fifty years, the volcano of the island of Fogo, in the Cape de Verds, has startled the place from its propriety, and driven the inhabitants from their cultivated grounds in its own neighbourhood. Torrents of burning lava issuing suddenly from its seven mouths have overwhelmed the cattle and plantations, and brought unlooked-for destitution on the colonists, who, seduced by the long immunity of the island,

had invested their hopes and labours in the dangerous vicinity.—*Athenæum*, July 31, No. 1031.

EXTENSIVE SLIP AT SHAKSPEARE'S CLIFF.

Last spring, this Cliff suffered from another of those falls which, since the time of our honoured bard, have lessened its altitude. A surface of chalk, 254 feet in height, extending to a length of 353 feet on the eastern face, 15 feet thick, measuring 47,131 yards, and supposed to contain about 48,000 tons of chalk, has scaled off and fell to the base. From a fog at the time, the slip was not seen; but the noise of the fall was heard at a long distance. This recent fall will, doubtless, repay the search of the geologist. A smaller fall of about 10,000 cubic yards has since occurred.—*Dover Paper.*

EARTHQUAKES IN TUSCANY.

From a statement made to the British Association, by Mr. W. J. Hamilton, it appears that two kinds of shocks have been experienced in Tuscany: the first a vertical shock, by which the greatest destruction in towns has arisen, and supposed to be only experienced directly over the focus of the Earthquake; the second a vibrating motion in a horizontal direction. The effect produced on buildings was greater over the tertiary strata than when they were erected on secondary or igneous rocks.

Mr. Mallet quoted Dolomieu's account of the earthquake of Calabria, where there was also less destruction on solid rocks, but the greatest at the junction of strata of unequal age and density.

EARTHQUAKES IN 1847.

On 26th March, 1847, at 1½ P.M., a shock of an Earthquake was felt at Catania—slight and harmless, indeed, but sufficiently strong to give a warning to all the inhabitants. All eyes were immediately directed to Etna; but old Mongibello "gave no sign."

On the 10th of July, 1847, at 10h. 50., two shocks were felt in Fécamp and its neighbourhood. The first was the heaviest, and accompanied with the lumbering noise of loaded waggons. The undulations were apparently from N. to S. The duration of the first shock was about fifteen seconds, of the second only about two. The time of a previous occurrence of earthquake at Fécamp was 1782 or 1783.—*Literary Gazette*, No. 1591.

HUMAN FOSSILS.—GEOLOGY OF TEXAS.

The Eighth Annual Meeting of the American Association of Geologists and Naturalists has been held at Boston, and been attended by a large number of scientific men from all parts of the Union. Considering that the Atlantic flows between the continents, there was also a fair sprinkling of learned Europeans. Prof. Rogers, of the University of Virginia, presided over the meeting. Among the papers read, we may mention one by Prof. Wailes upon the Natchez Bluff formations, chiefly interesting for the explanation which it afforded, in confirmation of the views of Mr. Lyell, of the probable origin of the fossil human bone

said to have been found, among the bones of the *megalonyx* and other extinct animals, in a deposit estimated by geologists to be thirty thousand years old. (See page 257 of the present volume). Dr. Roemer, of Berlin, sent out under the authority of the Prussian Government to examine the Geology of Texas, made a verbal statement of the results of his explorations. He had discovered a most remarkable analogy between the cretaceous formations of Texas and those of the northern shores of the Mediterranean—that they were, indeed, *identical*. He found also that the deposits of New Jersey correspond with those of North Germany and England. The grand conclusion to be deduced from these facts is, that the *isotherma lines* at the period of these formations were precisely where they now are, and that, therefore, no relative change in climate has taken place since the remote geological period of their deposit. The general heat of the globe may have been reduced, but at that period the difference in the temperature of corresponding latitudes in the eastern and western continents was as marked as now.

ON THE FOUNDATION OF A NEW GEOLOGY. BY PROF. G. BISCHOF, OF BONN.

"For a number of years," says Prof. Bischof, "I have contemplated the publication of a Geology based on chemical and physical principles. With this view, I have made observations during journeys, principally in the neighbourhood of my own residence, which is so interesting in a geological point of view, and I have carried on experiments in my laboratory, in order to study nature in her formations and changes. It will readily be admitted that it was necessary to examine geology in a chemical and physical point of view; for our geologists, for the most part, are neither chemists nor natural philosophers; and to endeavour to explain, without chemical or physical knowledge, the chemical operations which have taken place in the great laboratory of nature, appears to me a vain attempt. Werner wished to explain all by the Neptunian theory, at a time when chemistry had scarcely done anything for geology. His system is exploded. It has been succeeded by Huttonianism, which has likewise been pushed too far, and has done more injury in its turn than all the Wernerians. I shall shew that it is altogether a vain attempt to endeavour to explain all by either of these two methods.

In the present state of science, we cannot doubt that the crystalline rocks owe their origin to an igneous fusion. But we no longer meet with granite, basalt, diorite, &c., in their primitive condition; water has everywhere produced changes more or less considerable, and we possess many observations on the porosity of the densest rock. The whole family of zeolites, all the hydrated minerals, and the carbonates in the crystalline rocks, are secondary formations of minerals originally the same, but now wrought up again by carbonic acid, oxygen, and the other bodies which form a part of the water. Mineral springs which issue from great depths only form a particular case, and these are the waters which, with a small quantity of carbonic acid and oxygen, have produced at the surface the most important phenomena, and, as I shall shew, are producing them still.

During my investigations, I have found great assistance in the great number of facts which mineralogical chemists have made known; but there are, at the same time, many blanks to be filled up, and my own exertions will be insufficient for that purpose, unless I obtain assistance.

It may be demonstrated mathematically, that all the sedimentary formations, transition masses (with the exception of transition granites and basalts), and all the substances inclosed in drusy cavities, are derived from crystalline rocks. These have furnished the materials, and the waters have conveyed the quartz, calcareous spars, heavy spars, metals, and other substances, which fill the cavities, into their present beds. Of this I am perfectly convinced by an examination of the amygdaloidal rocks of Oberstein.

M. Rose has informed me, that every time he has made sulphuretted hydrogen pass into minerals dissolved in acids, he has remarked particular reactions. The precipitates have often presented copper, and as this precipitate is always very small, and does not enter into the formula, it has been neglected, as forming an uninteresting mixture. In one point of view, however, these minimum quantities are of very great importance, and it is to be regretted that the anxiety to find a chemical formula should be greater than that which should be manifested in searching out mixtures continually intervening, although in the very smallest proportions. For example, if it could be demonstrated that in the species of felspar, as in the Amazon stone, copper and other metals are always present, although in the smallest proportions, nothing could be more easy than to explain the origin of minerals in rents and veins, by taking into account the enormous masses of felspar which must have been destroyed by atmospheric phenomena. The minimum quantities in fossils usually indicate the way in which the fossil has undergone a transformation. Thus, the small proportion of potassium in fahlunite, indicates its passage into mica, and the mineralogical researches of M. Haidinger strengthen this opinion. How important, then, would be the comparative analyses of condiorite, fahlunite, gigantolite, pinite, &c., if we met with them simultaneously in the same crystalline rocks, and passing into one another!

When we observe barytes as the distinct companion of the mineral manganese, we cannot doubt that the manganese has been conveyed from mountain-rocks into transition-fissures; consequently, whenever we meet with oxide of manganese, we ought also to find barytes. We are also forced to admit that the barytes must be present, in the state of silicate, in the amygdaloidal rocks, when we find it in the anfractuosities of barytic hermatose. In the amygdaloidal rocks of Oberstein, in the anfractuosities of which this species of hermatose occurs, I have not hitherto, it is true, met with barytes, but very obvious traces of strontian are perceptible. Certainly barytes often presents itself to chemists in the analysis of minerals; it may often, in consequence of its small proportion, have been confounded with lime, and the chemist, who follows a formula, pays little attention to it if it contradicts the results. But although I express myself with some freedom on the disorder of formulas, I think we cannot dispute their competency to the author of a stochiometry. When chemical formulas are used with reserve, they may be of great ad-

vantage; but it is truly puerile to see the efforts that are made to include, for example, all the results of the analyses of the tourmalines in a single formula.—*L'Institut; Jameson's Journal*, No. 86.

GEOLOGY OF BARBADOES.

Sir R. H. Schomburgk has communicated to the British Association, a paper "On the Geological Structure of Barbadoes, and on the Fossil Infusoria, described by Prof. Ehrenberg, from the Tertiary Marls of that Island." Barbadoes is about twelves miles in length from north to south; about one-seventh part, forming the district of Scotland, consists of tertiary sandstones and limestones, rising to the height of nearly 1200 feet above the sea. Over the rest of the island raised coral reefs cover the entire surface, which is divided by vertical walls of coral rock, some of them nearly 200 feet high, into six terraces, indicating as many different periods of upheaval. In the lowest of these terraces, fifteen or twenty feet above high water, Indian hatchets have been found in the reef, showing that the last movement had taken place within the human period. The shells found at the height of 150 and 300 feet above the sea still live upon the adjacent coast. In the southern part a well had been dug to the depth of 240 feet through compact coral rock. The highest part seems to have been the centre of the elevating force: from this point ravines, some of 350 feet in depth, radiate in all directions towards the sea. The tertiary rocks of the Scotland district are more or less inclined, and sometimes vertical, or contorted. The marl beds, which form the greater part of the series, are several hundred feet thick. Bitumen, bituminous coal and sandstone, clays and ferruginous sands, are also found at Mount Hillaby and Springfield. Burnt Hill, near Conset's Bay, is reported to have been set on fire accidentally, and to have continued burning for five years. Slags are found on the surface bearing distinct marks of fire; and sandstone, containing bitumen and mineral oil, abound in the neighbourhood. The summit of Bissey Hill, 986 feet above the sea, consists of silicious limestone, containing teeth of two species of shark (Lamna and Odontaspas), spines of Echini, and shells, one of which (*Scalaria Ehrenbergii*) is considered by Prof. Forbes to belong to the miocene period. In the white marls of the Scotland district M. Ehrenberg has discovered the silicious skeletons of nearly 300 species of microscope infusoria. These belong to a group called Polycistina by M. Ehrenberg, and to fifteen genera found hitherto in the marls of Sicliy, at Oran in Africa, in Greece, in the tripoli of Richmond in Virginia, and in Bermuda; some of them are forms now living in the North Sea, and at the bottom of the sea near the South Pole. Prof. Ehrenberg remarks, that whilst phosphate of lime is the most important element of the bones of the vertebrate animals, and carbonate of lime the chief material in the skeletons of the molluscous animals and zoophytes, silica is almost peculiar to these minute races of infusoria. Some of the marls in which these silicious animalcules are found contain a large admixture of pumice, giving it the character of volcanic tufa. Sir R. I. Murchison remarked, that nothing was more likely than that volcanic dust of ashes, dispersed by winds and streams, should at last form a sedimentary deposit, mingled with the remains of organized beings.—*Athenæum*, No. 1028.

Astronomical and Meteorological Phenomena.

THE GREAT SOLAR ECLIPSE.

On Saturday morning, Oct. 9, 1847, the weather was so very cloudy at nearly all places in the south of England, that no observations could be made of the Solar Eclipse. This state of the sky appears to have prevailed generally wherein the eclipse would have been seen annular, except about Walmer, Dover, and Margate, at which places we understand that the eclipse was seen, but we do not know whether any observations were made there. The eclipse was seen well at Nottingham, and generally in the north of England. A Correspondent at Kirkby Moorside has sent us the following particulars:—

"The town of Kirkby Moorside is about thirty miles north of the city of York, by the side of a considerable range of hills, east and south. From the top of these hills was the eclipse seen. It was about half after six when I ascended (previous to ascending, I could only discern the reflection of the rays above the hills); at that time the sun was visible and bright, save about a third of the part to the south; this continued gradually to proceed until about forty minutes after seven, when it resembled the plate on the northern limit; then the mist *immediately rose* from the valleys around, and encompassed the whole, leaving a faint appearance at the top, similar to the plate of the sun shining through. This lasted for about one minute and a half; at that time it was very cold, and neither houses nor trees could be seen below. To the north-west, the clouds were gathered in dense masses. Shortly after, when the sun shone out again, they dispersed. I must mention, also, that, previous to the mist rising, the whole atmosphere, east and south, was one continued clear, bright canopy. The greatest eclipse, then, I should say, was forty minutes past seven, according to my judgment. Every circumstance connected with it, save the variation at its greatest eclipse, was exactly as given in the chart. Throughout the day it continued to shine brilliantly, occasionally shadowed with clouds for a short time."

It has been generally remarked, that the degree of darkness was somewhat less than was expected; but it is a well-known fact that it is the last portion of the sun that is hidden which causes the great darkness in eclipses; and it was the knowledge of this fact which caused us to say in our Almanack, that "a very great degree of darkness was not to be expected." The degree of darkness during the great eclipse on May 15, 1836, which we observed, was less than it was previously expected to be.—*Mr. J. Glaisher, in the Illustrated London News*, No. 285.

M. Arago has detailed to the Academy of Sciences, at Paris, an account of the observations made on the above Eclipse by MM. Mauvais and Goujon, who had gone at his request from Paris to Orleans, and hy M. Lausier, who had gone to Clermont in the Oise. At this latter place, the atmosphere was even in a more unfavourable state for observations than in Paris, but at Orleans MM. Mauvais and Goujon were able to perceive the eclipse at about 19 minutes after six. The sun was at that time eclipsed to the extent of about the fourth of its diameter. They

began to perceive the occultations of the spots; but the great undulations of the atmosphere, which gave to the edges of the sun and moon a dentilated appearance, did not permit them to determine exactly the periods of the immersions. At half-past seven, the air being more calm, they prepared for the observation of the formation of the ring; which M. Mauvais describes as follows:—"The extremities of the horns of the sun were at this time exceedingly sharp, but without apparent deformations. The undulations of the air, however, gave them a serpentine aspect. When the horns had embraced the three-fourths of the circumference of the moon, they began to advance more rapidly one before the other, and their movement of progression was very sensible to the eye. From this moment I remarked several times that this movement of progression was not uniform, but by starts: it was not continuous, for sometimes a luminous detached trace of light was seen in front of the horn. The obscure interval which remained between two was at first about ten seconds; it filled gradually with light, and the detached parts blended into each other insensibly. These detached points appeared first weak, and less resplendent than the rest of the sun; but by degrees they acquired more brilliancy, without change of colour. When the extremities of the two horns of the sun were only about 25° from each other, there was suddenly formed a suite of luminous points, to the number of ten or twelve, separated from each other. They bore a great analogy to the tops of the mountains of the moon, which are perceived in the first quarter, in the obscure part and near the lighted position. The rupture of the ring was observed at $7^h\ 36^m\ 22^s\ 7$. But the difficulty of choosing the instant at which the ring might be considered to be perfectly formed rendered very uncertain the determination of these two phases of the eclipse. I did not perceive the long black stripes said to have been seen in other eclipses, nor the chaplets of round beads, nor the dentilated asperities." M. Mauvais examined attentively the obscure surface of the moon with a Savart polariscope. He saw no trace of polarization. He attempted several times to perceive outside the sun the obscure portion of the moon which he had seen in the preceding eclipse at Perpignan,—but saw nothing similar. The termination of the eclipse took place at $8^h\ 57^m\ 48^s$.—*Athenæum*, No. 1044.

Signor Gallo, an Italian *savant*, has communicated to the *Osservatore Triestino*, the following particulars relating to a disputed phenomenon for which the above eclipse was anxiously watched.—"The beautiful eclipse which we yesterday admired was announced by me as early as January, 1846, in the 'scientific gathering' at Rome directed by Dr. Polomba. That announcement determined the Chevalier Ernesto Capocci, director of the Royal Observatory at Naples, to pay us a visit for the purpose of verifying a phenomenon which—pointed out by some astronomers of antiquity, and again witnessed by Baily in Scotland, during the annular eclipse of the 15th of May, 1836,—was not verified on the occasion of the memorable total eclipse of the 8th of July, 1842. The following is the phenomenon in dispute. In an annular eclipse, the western limb of the moon appears indented like a saw, the instant it begins to be internally detached from the sun's western limb, that is to say, when the ring is formed.

These indentations immediately expand; and almost simultaneously the limbs of the two stars appear united by rectilinear streaks, parallel, black, and perfectly distinct. Eventually, all these streaks suddenly disappear. This phenomenon occurs as if the limbs of the two stars were fastened together by a glutinous matter adhering to certain points of the sun, the ligaments of which are distended and finally snapped asunder by the motion of the moon. On the approximating of the eastern limb of the moon to the eastern limb of the sun, the phenomenon reappears in inverse order. The black and parallel lines are the first to appear instantaneously; the indentations succeed these lines; and finally, previous to the occultation of the sun's eastern limb, the limb of the moon appears crowned with irregular luminous grains between obscure spaces. These grains gradually dilate; and, on their disappearance, the eclipse comes to an end. An unexpectedly splendid serenity of the sky was very favourable for our observations; although in the short time which elapsed between the tempest of the night of the 8th of October and the most remarkable period of the eclipse, it was impossible for the atmosphere to regain that perfect calmness which is favourable for celestial observations. The Neapolitan astronomer, M. Capocci, was provided with a telescope made by Benchi, of Paris, forty inches in length, with a magnifying power of about forty; and I myself was furnished with an excellent dialitic from the manufactory of Kohlgrub, near Monaco, in Bavaria, 28 inches long, with a magnifying power of 45 to 70. Both of us, without neglecting the customary observations, devoted our especial attention to the above-named phenomenon, and verified it in all its details, and with signal success, at the moment of the rupture of the ring: and, although the agitation of the air made the limbs of the two stars appear somewhat confused and oscillating, we distinctly descried, and in great numbers, the mysterious obscure lines, which appeared to us most subtle and fugitive between the oscillations of the limbs. Far, therefore, from admitting, with M. Arago, that 'the astronomer, who has very exactly adapted his telescope to his own point of sight, ought not to perceive the phenomenon ('*Annuaire*' for the year 1846), I ought rather to affirm that we distinctly beheld it with telescopes regulated to our own point of sight: which we easily verified by reviewing the most apparent of the ten beautiful spots that appeared on the face of the sun during the eclipse. I may add, therefore, that the Cheval er Capocci having succeeded in artificially renewing the phenomenon no less than three times, and in each experiment retaining the eye-glass of Benchi's telescope at my own point of sight, every doubt was removed from my mind respecting the reality of the black lines; and I remain persuaded that the explanation which he had given me was far more conclusive than that of the Director of the Observatory at Paris."—*Athenæum*, No. 1048.

SOLAR SPOTS.

Mr. Griesbach has presented to the Astronomical Society, some drawings of Solar Spots, with a drawing made on September 27, 1843, of *Jupiter, seen without his moons*. This rare phenomenon was also

observed at Woodstock, Vermont, U.S. The following is an extract of a Letter from the President, inclosing Mr. Griesbach's Communication:—

"Herewith I enclose a letter from Mr. H. Griesbach, explanatory of the drawings of the solar spots, which I lately addressed to you, executed by him, and which, at my request, he has been good enough to copy for communication to the Astronomical Society, as a contribution to the history of the solar spots, and as the *commencement of a collection of such drawings*, which it appears to me highly desirable should be formed, with a view of securing, if possible, an unbroken series of such drawings, exhibiting a continuous view in the sun's surface for every day in every year in future, and as near an approach to it in past years as can now be recovered. It seems high time that some attempt of the kind should be made on a systematic and regular plan, as the only probably effectual means of arriving at a knowledge of the laws which govern these mysterious phenomena, and the periods, if any, which they observe in their formation, and thence of elucidating the nature of the sun itself. No single observer, at a fixed locality, can, of course, with any amount of diligence, contribute more than a very fragmentary series of such observations; nor, considering the frequency of long-continued runs of cloudy weather extending over immense tracts of country, could even the united observations of all Europe avail to secure such a continuous series as there is a necessity of obtaining. If, however, it were to be made known to observers in every region of the globe, that a permanent establishment, such as the Astronomical Society, interested itself in the formation of such a collection, and had opened a *department in its archives for the reception and arrangement of such contributions from all quarters*, there can be little doubt that many individuals, resident in climates habitually serene, would be induced to make and contribute diurnal representations of the solar disc. Should the Astronomical Society think proper to issue any prospectus or notice calling for such contributions, it would, of course, be desirable that the plan should be cast so as to secure a certain degree of uniformity in their execution, both as respects the hour or hours of the day, *when*, and the scale *on which*, they should be made. If made, for instance, at, or as nearly as possible at, noon, observations made on the same day in Europe, India, Australia and America, would, in effect, furnish not merely a diurnal but a quarto-diurnal series, adding much to the interest of the whole. Moreover, the exceeding facility with which photographic processes are executed, and especially the short time which the *Talbotype* process occupies, makes their execution on a given scale, and with every requisite degree of precision, easily attainable. In the hope that such a collection may be set on foot, it it my intention, so soon as I can find leisure, to execute and offer to the Society a series of copies on a uniform scale, corresponding to Mr. Griesbach's (that is to say, in which the disc of the sun shall be represented by a circle $3\frac{1}{2}$ inches in diameter), of all the drawings I possess of the solar spots."—*Athenæum*, No. 1050.

THE NEW PLANET, NEPTUNE.

Prof. Challis, in conformity with the wish of the Vice-Chancellor of

Cambridge University and the Observatory Syndicate, has given a second Report of the Proceedings in the Observatory, relative to the New Planet, the first Report of which was made December 12, 1846. The paper gives an account of subsequent observations, both of its position and physical appearance; with results respecting the orbit, deduced from observations by calculation. On January 12, Prof. Challis, for the first time, had a distinct impression that the Planet was surrounded by a ring. Subsequent observations made by his assistant, Mr. Morgan, with the striking coincidence of three distinct drawings of the form of the Planet, made by Mr. Lassell, of Liverpool (who was first to suspect the existence of a ring), the Learned Professor and Mr. Morgan appear to substantiate the statement of Mr. Lassell. The ratio of the diameter of the ring to that of the Planet, as measured from the drawings, is about that of three to two. The apparent diameter of the body of the Planet, taken with the Northumberland Telescope, is nearly 3″.

In calculating the following second approximations, Mr. Adams has used the mean of the two places obtained on August 4th and 12th, and of the others he has selected nine, which were the best determined, and separated by convenient intervals. All the results are calculated for the epoch of 1846, August 8,0· mean time at Greenwich.

Heliocentric longitude of the Planet referred to the mean equinox of 1847,0	326 . 41 . 12,3
Heliocentric motion in longitude in 100 days	36 . 5,52
Heliocentric latitude south	30 . 31,4
Change of heliocentric latitude in 100 days	1 . 4,44
Longitude of the descending node	310 . 3 . 44,0
Inclination of the orbit	1 . 46 . 49,1
Distance of the Planet from the sun	30,008
Half the latus sectum of the orbit	30,238

For the sake of comparison with the above second approximation, the first results are given, from which it will be remarked, that the first and second approximations do not differ by any large quantities.

Heliocentric longitude	326° . 39′	Aug. 4, 1846.
Longitude of the descending node	309 . 43	
Inclination of the orbit	1 . 45	
Distance of the Planet from the sun	30 . 05	

The calculations give 59′ 8″ for the Planet's heliocentric motion from August 4 to January 15. This is so small an arc, that it is not possible to deduce, with any degree of certainty, those elements, the determination of which depends on change of the heliocentric distance. Mr. Adams has, however, obtained certain limiting results, which, as possessing considerable interest, are here subjoined:—

The eccentricity of the orbit cannot exceed 0·18. The most probable value is 0·06.

The most probable longitude of perihelion is 49° 58′, and true anomaly, 276° 43′; according to which the Planet is near the extremity of the latus rectum, and is descending towards perihelion. These results are extremely uncertain.

The mean distance is 30·5, with a probable error of 0·25; and the

corresponding sidereal period is 167 years, with a probable error of two years.

According to Bode's law of the Planetary distances, the mean distance of *Neptune* should be nearly 38. The actual mean distance differs so much from this, that it is concluded this singular law, which holds with reference to the other planets, fails in this instance.

The apparent diameter of *Neptune* to that of Uranus being, from the above determination of the distance, in the ratio of 3 to 4; its bulk to that of Uranus is in the ratio of 8 to 5.

The foregoing is the sum of the results derivable from the first series of observations. More exact information cannot be had until the Planet emerges from the solar rays.

Prof. Challis concludes his report by referring to the *name* of the Planet. He states that M. Struve, Professors Gauss and Encke, and Mr. Adams, have thought fit to adhere to the name of *Neptune*, and that, under all the circumstances, he considers it right to follow their example.

M. Struve, in a letter to Prof. Challis, says,—"The Palkova astronomers have resolved to maintain the name of Neptune, being of opinion that the name of Le Verrier would be against the accepted anology, and *against historical truth, as it cannot be denied that Mr. Adams has been the first theoretical discoverer of that body,* though not so happy as to effect a direct result of his indications."

Lieut. Maury, in a letter to the *Union*, U. S., announces the very probable discovery, that the new planet, Le Verrier, was observed as a fixed star by Lalande, in 1795.

NEW PLANETS.

THE *Times* newspaper has been the first to announce from Mr. Hind, the observer at Mr. Bishop's private observatory, the discovery of a New Planet—one of the group of *goddesses*. He had the boldness to risk the announcement upon the observed motion of *one hour;* and his confidence in his instrument and himself has been justified by the result. The following is the letter to the *Times*.

The New Planet Iris.

Sir,—In addition to the Berlin maps, which we have revised, and in some instances corrected, ecliptical charts of stars down to the tenth magnitude have been formed for some of the hours of right ascension, which it is Mr. Bishop's intention to publish as soon as they are completed. On the 13th of August, I compared Wolfer's map with the heavens, and was surprised to find an unmarked star of 8·9 magnitude in a position which was examined on June 22 and July 31, without any note being made. The mere existence of a star in a position where before there was none visible, would not have been sufficient to satisfy me as to its nature; because during an eight months' search I have met with very many variable stars, a class which I believe to be far more numerous than is generally supposed. But, on employing the wire micrometer, we were enabled, in less than half an hour, to establish its motion, and thus to convince ourselves that I had been fortunate enough to discover a new

member of the planetary system. It may appear to many of your readers rather bold to announce the existence of a new planet from the detection of so small an amount of motion as 2 s. 5 in R. A.; but such is the firm mounting of the large refracting telescope and the perfection of the micrometers (for which we have to thank Mr. Dolland), that a far smaller change would have been sufficient to convince us as to the nature of the object in question.—Mr. Bishop has fixed upon Iris as an appropriate name for the New Planet; and we hope that astronomers generally will join with us in its adoption. The following are all the observations we have yet made:—

	G. M. T.	R. A. of Iris.	South decl.
	h. m. s.	h. m. s.	° ′ ″
Aug. 13	9 39 46 ..	19 57 30·38 ..	13 27 21·5
— —	10 37 24 ..	19 57 28·41 ..	13 27 27·6
— 14	9 23 58 ..	19 56 38·30 ..	13 29 14·0
— 15	9 0 39 ..	19 55 47·64 ..	13 31 4·3

I remain, sir, your most obedient servant,

J. R. Hind.

Mr. Bishop's Observatory, Regent's Park, Aug. 17.

This observatory of a London manufacturer of wines and spirits, has now added *three comets and a planet* to our system; to say nothing of other work! We may add, that the planet was observed at Cambridge on the 14th, and at Greenwich on the 15th. With a low power its light is very intense, but no disc is apparent. The low altitude and the weather have been rather against observations of its appearance. *Athenæum*, No. 1034.

In the above journal (No. 1043, date Oct. 23) we find the following:—Mr. Hind is once more before the public as the discoverer of another planet, not far from the star 15 Orionis. "It shines," he says, writing to the *Times*, "as a star of the ninth magnitude, with a bluish light. By micrometrical comparisons with Bessel, V. 48, the following positions were obtained:—

	G. M. T.	Right Ascension.	North Declension.
	h. m. s.	h. m. s.	° ′ ″
Oct. 11 at	11 40 4 ..	5 3 40·11 ..	14 3 35″4
—	15 4 10 ..	5 3 41·51 ..	14 3 26·2
—	15 52 27 ..	5 3 41·97 ..	14 3 25·3"

It is probable, he adds, that this object is one of the group of planets between the orbits of Mars and Jupiter, at present not far from its stationary point.

Since the epoch of discovery, the brightness of the planet has considerably increased, and now equals that of a star of the eighth magnitude. At Mr. Bishop's request, Sir John Herschel has named it "Flora," with a flower (a rose?) for the symbol.

HENKE'S NEW PLANET.

Henke, at Driesen, the discoverer of Astræa, has discovered a new planet, which has been since observed at Berlin, Hamburgh, Altona, and Paris, whence the following positions have been obtained:—

	Mean time. h. m. s.	Right Ascen.	Declin.
Berlin July 5	10 12 7·1	256°51′35″·4	−4° 8′29″·2
Hamburgh 6	12 25 54	250 38 20 ·4	−4 15 31 ·3
Altona — 7	16 46 9·2	256 27 50 ·9	−4 22 8 ·0
Paris — 10	11 30	255 55	−4 43
Paris — 11	10 47 15·2	255 44 56 ·7	−4 47 9 ·6

The two observations at Paris give a diurnal motion in right ascension of 9′39″, and in declination of 4′24″. The planet is a star of about the ninth degree of magnitude.

MISS MITCHELL'S COMET.

This Comet was seen in America, on October 1, by Miss M. Mitchell, of Nantucket, and was observed at the Observatory of Cambridge, U.S. October 7. It was seen October 3, at Rome, by Father De Vico; Oct. 7, by Mr. Dawes, with the naked eye, at Cranbrook; and October 11, by Mrs. Rümker, at Hamburg. Mr. Dawes says that, on October 7, he remarked it "as a hazy star of the fifth magnitude, near *ω Draconis*. Examination with the 8½ foot refractor proved it to be a large comet, its rapid motion being speedily detected. On the 11th, it had the light of a star of the fourth magnitude, near *η Herculis*. The nebulosity in the telescope extended over 30′, nearly round, much condensed in the centre, but without stellar nucleus. A star of the tenth magnitude (Herschel's fourteenth) was distinctly seen through the exact centre of the comet."

GRAPHICAL METHOD OF COMPUTING AN OCCULTATION. BY PROFESSOR CHEVALLIER.

This method is founded upon Bessel's made of computing the time of the Occultation of a Star by the Moon. The apparent place of a star with respect to the centre of the Moon may be expressed by two groups of quantities, one depending upon the position of the Moon with respect to the centre of the Earth; the other depending upon the place of observation. The quantities which compose the first group may be computed for a time near the middle of the occultation by simple formulæ; and are already computed in the Berlin Ephemeris for all stars occulted at Berlin. The quantities which compose the second group may be taken from tables easily computed for a given place, or may be computed expressly for the given epoch, in a very simple manner. The differences of the corresponding quantities in each of these groups is taken; and laid down on a scale, in which the earth's equatorial radius is the unit. A circle described with a radius 0·2725 represents on the same scale the semidiameter of the moon, and the times of the immersion and emersion of the star are given at once to the nearest minute by measurement on an accompanying scale; —the places of immersion and emersion upon the moon's disc being represented by the same process. The same scale once drawn serves for all occultations.—*Athenæum*, No. 1027.

THE NEBULA OF ORION RESOLVED.

At the eighth annual meeting of the American Association of Geolo-

gists and Naturalists, held at Boston, was read the following letter from Mr. Bond, to President Everett of Harvard University, announcing the resolution of the nebula of Orion by its means—and communicated to the Association—is worth adding to the particulars which we have already given of this transatlantic marvel:—

"You will rejoice with me that the great nebula of Orion has yielded to the power of our incomparable Telescope. This morning [Sept. 22], the atmosphere being in a favourable condition at about three o'clock, the Telescope was set upon the Trapezium in the great nebula of Orion. Under a power of 200, the fifth star was immediately conspicuous; but our attention was directly absorbed with the splendid revelations made in its immediate neighbourhood. This part of the nebula was resolved into bright points of light. The number of stars was too great to attempt counting them; many were, however, readily located and mapped. The double character of the brightest star in the Trapezium was readily recognized with a power of 600. This is 'Struve's sixth star;' and certain of the stars composing the nebula were seen as double stars under the power. It should be borne in mind that this nebula and that of Andromeda have been the last stronghold of the nebular theory; that is, of the idea first thrown out by the elder Herschel, of masses of nebulous matter in process of condensation into systems. The nebula in Orion yielded not to the unrivalled skill of both the Herschels, armed with their excellent reflectors. It even defied the power of Lord Rosse's three-foot mirrors, giving not the slightest trace of 'resolvability,' or separation into a number of *single* sparkling points. And even when, for the first time, Lord Rosse's grand reflector, or six-foot speculum, was directed to this object, 'not the veriest trace of a star was to be seen.' Subsequently his Lordship communicated the result of his further examination of Orion, as follows:—'I think I may safely say that there can be little, if any, doubt as to the resolvability of the nebula. We could plainly see that all about the Trapezium is a mass of stars, the rest of the nebula also abounding in stars, and exhibiting the characteristics of resolvability strongly marked.' This has hitherto been considered as the greatest effort of the largest Reflecting Telescope in the world, and this our own Telescope has accomplished."

BRILLIANT AURORA.

Mr. James Glaisher, of the Royal Observatory, Greenwich, has communicated to the *Illustrated London News*, the following details of a brilliant exhibition of Aurora, on Sunday, Oct. 24, 1847:—

It was first seen at about half-past six in the evening, and occasional streamers alone were seen till 9h. 45m. After 9h. 55m. it was constantly changing; at 9h. 55m. a portion was alone visible, presenting to the eye the fan-shaped appearance, and exhibiting all the tints of the most brilliant sunset; the column appeared to be composed of streamers, shading from the most intense crimson into the ruddiest and most brilliant orange; which orange again contrasting with the ruddy hue of the next portion, formed, by means of contrast upon contrast, an endless gradation of shade and colour; in fact, it was a truly gorgeous spectacle.

At 10h. 0m. the orange colour had entirely disappeared, and given place to an uniform deep crimson; the column had the appearance of a strong reflection from an immense conflagration; with suddenly, like the brisk unfurling of a fan, light white fleecy columns. The several columns between two red columns appeared to be divided into sections, and were of the most silvery light, shaded with a delicate and pure grey. The columns were perpetually glancing and shifting, though always with vertical motion; whilst the red portions continued unmoved. These movements of the central columns somewhat resembled, in appearance, the reflection upon a wall of a Gothic casement, lighted from within by some fitful and inconstant light. The rose-coloured extremities meanwhile remained immoveable, though it rather appeared that, as the central silvery lights fluctuated, now bright, now dim, their very extremities fluctuated in direct oppositon, the rosy hue becoming fainter, and inclining to a neutral tint, in proportion as the silvery brightness increased.

At 10h. 12m. A.M. the regular and casement-like appearance gradually disappeared, and assumed more of the character of the boundaries, although they still retained their fitful glancing motion, and their pale silvery hue. During the time of the above appearance, two or three Auroral masses, milk white, and cloud-like, floated from W.N.W. to the S.E., and were remarkable for a kind of pulsation within themselves.

At a quarter-past 10, the moon, which was shining with unusual splendour, was surrounded by a beautiful corona, consisting of four concentric circles; that which was the nearest to the moon was of a neutral tint, the next violet, then green, and the outermost red; the external edge of the latter passed just midway between the moon and the planet Mars.

Towards midnight the appearance became again very splendid, and traces of the Aurora existed till after 2 o'clock in the morning of Monday.

We quote the following from the *Athenæum*, No. 1045 :—

Cambridge Observatory, Oct. 28, 1847.

The Aurora Borealis witnessed here on the night of last Sunday was of a most remarkable description, and presented several peculiarities well deserving of being recorded. The commencement of it was noticed as early as six o'clock in the evening. At ten o'clock it had attained great brilliancy, and between the hours of ten and eleven its peculiar phenomena were most distinctly displayed. In this interval streamers rose at all azimuths from W. by S. through N. to E. by N. The aggregate of these streamers formed a kind of canopy, which covered considerably more than half the celestial vault, the part towards the south being free from auroral light. The streamers did not, as is usually the case, proceed from a luminous arch, but appeared to shoot up either from the horizon or from positions elevated a few degrees above the horizon. The beauty of the spectacle was much increased by large patches of a peculiar ruddy colour, more permanent in their character than the streamers, and formed principally in the W. and N.E. quarters of the heavens. The streamers themselves were for the most part white, and were constantly varying in intensity, or shifting their positions horizontally—while rapid pulsations were propagated though them in vertical directions. The most remark-

able feature of the phenomenon was the distinct convergence of all the streamers towards a single point of the heavens, situated a little to the east of the meridian and to the south of the zenith. Around this point a corona, or star-like appearance, was formed; the rays of which diverged in all directions from the centre—leaving a space about the centre free from light, in which I noticed at one time the rapid formation and disappearance of part of a circular luminous ring. It was easy to fix on the central point. According to an estimate made conjointly by myself and a friend at 10h. 10m. Cambridge mean time, it preceded the bright star Mirach, or β Andromedæ, 10m. in right ascension, and had greater North Polar distance by 2°. Consequently, by calculation, its azimuth was 18° 41′ from S. towards E. and its altitude 69° 51′. The azimuth appeared not to vary with the diurnal motion of the heavens. According to the above result, this singular point was situated in or very near a vertical circle passing through the magnetic pole. Some valuable inferences might be deduced if a similar phenomenon were witnessed elsewhere, and the time and position accurately noted. The Aurora was still faintly visible at one o'clock. Had it not occurred in bright moonlight, the splendour of this display would probably have equalled any ever observed in this latitude.—J. Challis.

FALLING STARS.

M. Arago and M. Babinet have made to the Academy of Sciences, at Paris, a report on the paper of M. Edouard Biot on Falling Stars. M. Biot divides his subject into two periods: one corresponds with a period comprised between the 18th and 27th of July of the Julian years, the other between the 11th and 20th of October. The most interesting part of the paper relates to the appearance *en masse* of falling stars, and the direction that they take. In China, as in Europe, says the author, this phenomenon has been absent at times for several years together, Between 960 and 1275 of the Christian era, the most frequent direction of the meteor has been towards that part of the heavens comprised between the south-west and the south-east.—*Athenæum*, No. 1004.

ON PERIODIC METEORS. BY THE REV. PROF. POWELL.

The chief object of this communication, made to the British Association, at their late meeting, was to place on record a table of all the remarkable appearances of luminous Meteors, which the author has been able to collect up to the present time, supplementary to the very complete list given in M. Quetelet's second Catalogue (Nouv. Mém. de l'Acad. de Bruxelles, tom. xv.) which comes down to the year 1840. This list is, doubtless, imperfect; but the author submits it to the British Association in the hope that its deficiencies will be filled up by the contributions of other members. He wishes to annex a few remarks on one or two points connected with the theory of those appearances. The question so much disputed as to the connexion of *luminous meteors* with the fall of *meteoric stones*, appears to the author to be answered sufficiently by observing—1st. That some cases of such connexion are undoubtedly estab-

lished. 2nd. That daylight is necessary to trace the actual fall of matter, when, consequently, a luminous meteor would be *invisible*, unless of unusual brilliancy; while the darkness which renders a meteor *visible* precludes the possibility of tracing the fall of stones. 3rd. Matters may fall in portions or a state of division too small to trace; and there is evidence, or strong probability, of matter having a meteoric origin in various lighter forms besides that of metallic or apparently fused masses. As to the *forms* of masses known to have fallen, they are by no means generally *angular* or *fragmentary*, as sometimes asserted; in many instances being *whole*, and rounded in form,—sometimes, also, broken into fragments *by their fall*. There is no evidence of a mass *bursting* to pieces by an explosion; the detonation heard may be purely *electric*. Of the *size* of meteoric masses no sufficient evidence exists. The *apparent* diameters cannot be easily determined on account of the velocity of motion; and if they could, this would only give the size of the flame (if it be due to combustion) and not that of the solid mass, if there be one. If the height be too great to allow combustion, still less can the apparent size of the electric flash be any guide or proof of the existence of any solid body at all. Such small solid bodies *may* circulate in the solar system, but not probably in any great number or of large size, unless as truly planetary or satellitary bodies: but unformed diffused masses of matter, like that of comets or the zodiacal rings, we know to be circulating in many parts of space; and it is by *condensation* out of this, that, as probably the existing planets, so, also, lesser asteroids and satellites may be continually forming, as likewise meteoric masses within the sphere of the earth's influence, agreeably to Mr. Strickland's hypothesis. The observations of Brande, Benzenburg, and others, as is well known, have assigned great heights to many meteors, varying from 5 to 500 miles. But M. Quetelet has shown (2nd Mém. de l'Acad. de Bruxelles, tom. xv.) that the *mean* height is from 16 to 20 leagues, or *within* the limits of the atmosphere. Hence the majority of them *may* become luminous from *combustion*. Electric light can be displayed in vacuo. Hence we may have various gradations of the same phenomenon from purely electric flashes or explosions at great altitudes to more or less complete combustion at lower; by which the whole mass *may be consumed* and *dissipated*, or may be partially burnt, and the metallic ingredients more or less perfectly *reduced* or *fixed*, and in this condition portions or masses may fall to the earth. And the explosion is not the *bursting* of a mass, but an electric discharge: the particles or masses which fall are *portions*, not *fragments;* and the effect, instead of being one of *breaking up*, is one of *consolidation*.

Papers were also read by Dr. Foster "On Meteors," and by the Rev. T. Rankin "On Phosphoric Meteors." A lengthened discussion ensued on the reading of Dr. Forster's communication on Meteors, in which he endeavoured to refute the cosmical hypothesis of the cause of meteors recently adopted by many astronomers. Dr. Foster stated that he was the first person who suggested the idea that these meteors were periodical, as early as the year 1811; but that he had long ago given up the point, and attributed their apparent periodicity to changes in the electrical atmos-

phere. He concluded his paper by the production of a problem which explained and confirmed Aristotle's hypothesis of the cause of falling stars.—*Athenæum*, No. 1027.

NO PROOF OF THE PRESENT EXISTENCE OF A SINGLE STAR OR PLANET.

Sir J. Herschel says, in an "Essay on the Power of the Telescope to penetrate into Space,"—a quality distinct from the magnifying power informs us that there are stars so infinitely remote as to be situated at the distance of twelve millions of millions of millions of miles from our earth; so that light, which travels with a velocity of twelve millions of miles in a minute, would require two millions of years for its transit from those distant orbs to our own; while the astronomer who should record the aspect or mutations of such a star, would be relating, not its history at the present day, but that which took place two millions of years gone by!

CALORIFIC POWER OF THE LIGHT OF THE MOON.

M. Melloni has shown, beyond doubt, that the Rays of the Moon are calorific to a slight extent. It was done by concentrating the rays of the moon with a lens over three feet in diameter, upon his thermoscopic pile. The needle was found to deviate from 0°·6 to 4°·8, according to the phase of the moon. Numerous precautions had to be attended to, so as to avoid all error arising out of currents of air, &c.—*Letter from M. Melloni to M. Arago.*

RATIONALE OF CLIMATE.

However great may be the fluctuations of temperature in the same months and seasons—however sultry the summer, or cold the winter, in any particular year, its mean temperature varies but little from the climatic or average actual mean of the locality, when once correctly ascertained; and, even the greatest variation between one year, and any other the most opposite in character, and extending over a long period of time, when accurately expressed in figures, appears so trivial, that except to the meteorologist it fails to convey any adequate idea of the excess or deficiency of heat, or of the absolute difference in temperature between the periods in question.—*Mr. J. F. Miller; Jameson's Journal*, No. 84.

CLIMATE OF 1846.

Mr. J. F. Miller, of Whitehaven, has communicated to *Jameson's Journal*, No. 84, an interesting *resumé* of the Weather of 1846. In July, he notes:—On the afternoon of the 5th inst., this county was visited by a heavy thunder-storm, accompanied with hailstones of an almost incredible size. At Cleater some of the hailstones measured $\frac{3}{4}$th of an inch in diameter, or two inches round, nearly ten minutes after they had fallen. At Distington and Gilgarron some of them were three inches in circumference. In Lamplugh, many of the hailstones were as large as an ordinary plumb, and, on examination, were found to be invested with a thin covering of snow, but within was a piece of ice, hard and clear as crystal. In Bassenthwaite the hailstones are described as

the size of an ordinary pigeon's egg, and many of them not less than three or four inches in circumference.

To sum up the peculiarities of 1846 in a few words, (says Mr. Miller,) the summer is memorable for its excessive heat, its unprecedented mortality, and the unusual number and violence of its thunder-storms:—the whole year is marked by the high temperature, dampness, and stagnant condition of the atmosphere.*

STORMS OF 1846.

Mr. E. Highton has printed an interesting paper, "On the Effects of Heavy Discharges of Atmospheric Electricity, as exemplified in the Storms of 1846 (including an account of the Destruction of St. George's Church, at Leicester, on 1st of August), with Remarks on the Use and Application of Lightning-Conductors." The church, a new and handsome building, was entirely destroyed by the effects of the thunder-storm of the 1st of August, the steeple having been burst asunder, and parts of it blown to a distance of thirty feet in every direction, while the vane-rod and top part of the spire fell perpendicularly down, carrying with it every floor in the tower, the bells, and the works of the clock. The falling mass was not arrested until it arrived on the ground, under which was a strong brick arch, and this also was broken by the blow. The gutters and ridge-covering were torn up, and the pipes used to convey the water from the roof were blown to pieces. The author, in comparing the power developed in this discharge of lightning with some known mechanical force, stated, that 100 tons of stone were blown a distance of thirty feet in three seconds; and consequently a 12,220 horse-power engine would have been required to resist the effects of this single flash.

Since the occurrence of the numerous storms of 1846, Mr. Highton had examined the Cathedral of St. Paul's in London, to ascertain how far this noble pile of building is protected from the effects of lightning. He found that the two small turrets have lightning-conductors erected, but the central dome has none. He found, however, that the position of the spouts and other metallic connexions is such, that he considers if they are preserved as they now are, the building will be free from damage by lightning; but should they be removed at any time, and glass or porcelain be employed in their stead, then the main part of that noble building would be in constant danger from every storm that passes over the city. He concluded by urging the importance of a correct and systematic principle being acted on in the new Houses of Parliament, with a view to securing them from the disastrous effects of lightning.

* The mean temperature of the last quarter of 1846 (Sept. 30 to Dec. 31), is 1°·115 under the average. The temperature would have been above the average, but for the unusual coldness of December. The mortality during the quarter is, again, very great; in this town the deaths are 150 per cent.—and, for the whole Union, they are 130 per cent. above the average of the preceding seven years. According to the Registrar-General's returns, the deaths throughout the kingdom, in the last quarter, are 7,311 more than the corrected quarterly average of previous years, and 13,727 more than were returned in the corresponding season of 1845.

CHURCH STRUCK BY LIGHTNING.

THE parish church of Welton, Lincolnshire, was struck by lightning on August 29 (Sunday), when one person was killed, and many others injured. It appears that the lightning first struck the south-eastern pinnacle of the tower and threw down a portion of the battlement. It then passed into the tower, and melted an iron-rod connected with the clock. Here the current of electricity was divided, one portion having descended on the exterior, and entered the earth, while another portion descended inside, and having perforated the stone-work of the door in the interior of the church, and thrown down the clock-dial inside, passed along the north aisle. In this part of the church were suspended three small brass chandeliers, which served as conductors for the electric fluid downwards, as all the persons standing underneath them were injured. On the floor of the pew being inspected, it was found to be perforated with thirty or forty small holes. In passing from the north aisle into the chancel, it went out by five different holes in the east window, and perforated the stone wall, upwards of two and a half feet in thickness, in two different places.

TREES MOST AFFECTED BY LIGHTNING.

FIG trees and cedars are rarely struck with lightning; the beech, larch-fir, and chestnut, are obnoxious to it; but the trees which attract it most are the oak, yew, and Lombardy poplar; whence it follows that the last are the trees most proper to be placed near a building, since they will act as so many lightning conductors to it. Again, the electric fluid attacks in preference such trees as are verging to decay by reason of age or disease.—*Mechanics' Magazine*, No. 1235.

THE KEW OBSERVATORY.

MR. RONALDS has presented to the British Association, his fourth annual volume of Observations and Experiments made at the Kew Observatory; and stated that his preliminary experiments on the photographic registration of the atmospheric electrometer, the thermometer, the barometer, and the declination magnet, having been (long since) completed and published, and their results having warranted the cost and trouble of constructing apparatus of a durable and convenient character, a declination magnet and a barometer have been mounted at Kew, which scrupulously fulfil the conditions required, without the intervention of friction-rollers, levers, pivots, or similar mechanisms. He stated his intention to provide, during the ensuing year, complete apparatus, on like principles, for registering as many of the other meteorological and magnetic instruments as he may have the means of doing; and expressed a strong desire that we should possess strictly comparative observations of atmospheric electricity, magnetism, the aurora, &c. made at Alten, Hammerfest (in Finmark), at Bombay, and in this country; for it may, he said, be safely affirmed, that notwithstanding all that has been written about the relationship of the aurora with electric and magnetic phenomena, the regions, or apparent regions, of the aurora have never been subjected to electric observation in a manner at all approaching to accuracy or

comparability with observations made here or elsewhere. Neither has an electrometer at Bombay ever yet been fairly compared with one in England (or even in Europe probably). We have surely been deducing conclusions on this very curious subject without sufficient *matériel*.—*Literary Gazette*, No. 1591.

EXPERIMENT MADE AT THE KEW OBSERVATORY ON A NEW KITE-APPARATUS FOR METEOROLOGICAL OBSERVATIONS.

Mr. W. R. Birt (on the 14th of August) took some Kites, &c., to the Kew Observatory, for the purpose of endeavouring to ascertain how far it might be practicable to measure the force of wind at various elevations by their means, and (in the mere manipulation of his experiments) was assisted by Mr. Ronalds. After several trials, &c. they agreed that the sudden variations, horizontal and vertical, in the position of the kite, the great difficulty of making a kite which should present and preserve a tolerable approximation to a plane, that of measuring, with sufficient accuracy, at any required moment, its inclination, and lastly, the influence of the tail, would always tend to render the observation somewhat unsatisfactory. Mr. Ronalds then proposed to try the following method of retaining a kite in a quasi invariable given position. Three cords were attached to an excellent hexagonal kite of Mr. Birt's construction: one in the usual manner, and one on each side (or wing). The kite was then raised as usual; the two lateral cords were hauled downwards by persons standing at the apices of a large equilateral triangle (described upon the ground) until the ascending tendency became considerable (even when the force of the wind was at its minimum), and the three cords were made fast to stakes, or held in the hand. He had entertained no expectation of the favourable result of this simple and obvious contrivance. The place of the kite did not seem to vary so much as one foot in any direction, and it really appeared to him probable that a very large kite or kites might be employed in this kind of manner often and very cheaply as a substitute for a captive balloon in meteorological inquiries, or even (on a very extensive scale) for other requirements in military science, &c. An anemometer, a thermometer, an hygrometer, &c. of some registering kinds, &c., might be hauled up and lowered at pleasure (like a flag) by a person standing in the centre of the triangle (above referred to), and by means of a line passing through a little block attached to the kite. The cords and kite should of course be of pure silk, for the sake of lightness, combined with extreme strength, and the size and thickness in some measure adapted to the breeze or lighter air. The silk might be advantageously covered with a very light coat of elastic varnish.—*Philosophical Magazine*, No. 207.

GODDARD'S IMPROVED ANEMOMETER.

The advantages of this new instrument are stated to be—First, That the scale of time is five times greater within an equal compass of paper than Mr. Osler's. Secondly, That the register of direction is fully eight times as large, with equal-sized sheets, as that of the ordinary construction. Thirdly, The data registered are more comprehensive than those

of Whewell's, Osler's, or Foster's, viz.: 1. Miles of wind blown during the day. 2. Miles of wind blown in each direction. 3. Miles of wind blown between any given periods. 4. Hour and minute of the highest gust. 5. Hours in which most wind has blown. 6. Times of calm, and length of continuance. 7. Velocity of wind at any hour. 8. Time occupied by the wind going any certain distance at any period of the day. 9. Direction of wind at any minute. 10. Mean direction. 11. Direction of longest continuance. 12. Direction of the greatest passage of wind.

RADIATION OF HEAT FROM THE EARTH.

THERE has been communicated to the Royal Society, a paper "On the amount of the Radiation of Heat at night from the Earth, and from various bodies placed in or near the surface of the Earth," by James Glaisher, Esq., of the Royal Observatory, Greenwich.

In this paper, the author investigates the amount of heat radiated from nearly a hundred different substances fully exposed to the sky, consisting of clothing materials, different coloured wools, building materials, metals, &c., by means of placing upon them very delicate and accurate thermometers, which were noted at short intervals throughout the entire night. Occasionally, fifty instruments were in use at the same time, all of which had been tested, so that all differences in their readings were due either to locality or to the inherent quality of the substance upon which they were placed. The author found that the temperature of all dry bodies was the same when the sky was cloudy: but when the sky became only partially so, or cloudless, a great difference was always found to exist among them. The greatest difference he ever saw between the temperature of a body placed on the earth, and the air a few feet above it, was the large amount of 28°·5. In this section there are many other subjects of investigation, and the results are based upon upwards of 20,000 experiments.

The second section of the paper contains the researches made by the use of self-registering thermometers, extending over a period of four years uninterrupted, during which period the classified results from each night's observations are shown. The subject of this paper is quite new, and cannot fail to form the basis of many future researches on this important subject. In this paper it appears that the author has paid every attention that experience suggested, or reflection pointed out as being desirable, both in the observations as well as in their reductions.

METEOROLOGICAL SUMMARY FOR 1847.

(Communicated by DR. ARMSTRONG, *South Lambeth.)*

Months.	Temperature. Fahr. Max.	Fahr. Min.	Mean. Reaumur.	Mean. Centigrade.	Mean. De Lisle.	Fahr. Minutes diff. compared with 1846.	Atmospheric Variations. Mean Pressure in inches.	Difference compared with 1846.	Prevailing Currents.	Hygrometer. Rain and snow in inches.	Difference compared with 1846.	Modifications of Cloud.* Cirrus.	Cirro-stratus.	Cumulus.	Cirro-cumulus.	Cumulo-stratus.	Nimbus.	Stratus.
Jan.	50	28	1·3	1·6	147·5	+8	29·75	− 0·40	SW. NE. SE.	1·100	—1·600	:	*	:	:	:	*	
Feb.	15	14	0·0	0·0	150	—13	30·05	+0·58	SW. NE. NW.	0·145	—1·095	:	:	:	:	:	:	
March ..	60	20	3·5	4·4	143	—7	30·20	+0·05	SW. NW. SE.	0·750	—0·540	:	*	*	:	:	:	
April ..	64	28	6·2	7·7	142	—4	29·29	+0·28	SW. NW. NE.	0·960	—0·750	:	*	:	*	:	:	
May	72	38	10·2	12·7	130	—3	30·175	+0·85	SW.	1·370	—0·370	*	*	*	*	:	*	
June....	75	42	11·5	14·4	128	+8	30·22	+0·09	NE. SW.	1·475	+1·075	*	*	*	*	:	:	
July	88	51	14·2	17·7	123	—3	30·325	+0·325	NE. SW. NW.	0·760	—1·000	*	*	*	:	:	:	
Aug.....	90	47	16·0	20·0	120	—16	30·20	+0·07	SW. NE. NW.	1·45	—1·15	:	*	*	:	:	:	
Sept.....	72	35	9·3	11·6	133	—6	30·50	+0·25	NW. W. SW.	1·78	—0·04	*	*	*	:	:	:	
Oct.	68	30	7·5	9.4	136	—7	30·05	+0·33	SW. SE. NE.	2·156	—3·344	*	*	*	*	*	*	
Nov.....	64	26	5·7	7·2	139	—6	29·84	—0·53	SW. NW.	1·74	+0·29	:	*	*	:	:	*	
Dec.	62	28	5·7	7·2	139	+10	29·57	+0·46	NE. SE.	2·000	—0·17	:	:	*	:	:	*	

TABLE OF THE WINDS APPROXIMATELY.... } N. 14 days. NE. 62 days. E. 13 days. SE. 38 days. S. 12 days. NW. 46 days. W. 27 days. SW. 117 days. } On the remaining days, the wind variable, or none.

The greatest atmospheric pressure, 30·85 on March 3, 4; May 30, 31; June, 1, 2. Least, 28·44 on Dec. 6.—— Lowest temperature 15° on Feb. 11.——Strongest aërial currents on Jan. 14, 15, 18, 19, 20; Feb. 19; Sept. 16; Oct. 29, 30; Nov. 16, 21, 22.——Violent current from Dec. 4 to 8; rate of progress, 78 feet per second on the 5th.——Highest tides on Jan. 31; Feb. 15 to 20; Sept. 25, 26, 27; Dec. 22, 23, 24.—— Lowest tide this century on Sept. 14.——Slight fall of snow on Jan. 21; March 12; Dec. 28.—Heavy fall on Feb. 8,—on the ground till the 12th.——Thunder and lightning on May 29; June 8; July 7, 17; Aug. 8.——Unusual darkness on Aug. 14.——Dense fog on Dec. 23, 24, 30.——An aurora borealis of unusual splendour on Oct. 24.——During the whole year only 4 days cloudless throughout.

* The cloud of most frequent appearance is denoted by an asterisk; of rarest, by a colon.

Obituary

OF PERSONS EMINENT IN SCIENCE OR ART. 1847.

GREVENICH, the French sculptor.
J. P. NEALE, topographer and archæologist.
HENRY HOWARD, R.A.
CHARLES HOLTZAPFFEL, mechanician.
Mr. LISTON, the celebrated surgeon.
ANDRE' DE LUC, the eminent Swiss geologist.
Mr. M'CULLAGH, Professor of Natural Philosophy in Dublin College.
THE REV. DR. PEARSON, one of the founders and formerly President of the Astronomical Society.
LADY MARY SHEPHERD, natural philosopher.
WILLIAM SIMSON, painter.
MUSGRAVE L. WATSON, sculptor.
DR. WIGAN, author of "The Duality of the Mind."
ARCHIBALD SIMPSON, architect.
J. B. PAPWORTH, architect.
GEORGE ALLEN, architect.
DR. BURDACH, German physiologist.
ALEXANDRE BROGNIART, the eminent zoologist, botanist, geologist, and mineralogist: Director of the Royal Manufactory of Sevres.
COUNT DE VARGAS DE BENDEMAR, one of the most learned of Danish geologists.
MARY ANNING, of Lyme Regis, Dorset, discoverer of Fossils.
J. ARTHUR BRANDON, architect.
M. DUTROCHET, a member of the Paris Academy, in its section of Rural Economy.
WILLIAM COLLINS, R.A.
L. N. COTTINGHAM, architect.
DR. FELIX D'ARCET, chemist.
KEARNS DEANE, architect.
COL. BORY DE ST. VINCENT, botanist.
BARON BENJ. DELESSERT, botanist.
M. GAMBEY, Member of the Paris Academy of Sciences, in its Mechanical section.
FREDERIC DE GAERTNER, the Munich architect.

ERRATA.

Page 46, for "Mr. Matter," read "*Mr. Mather.*"
Page 92, for "Mr. Whewell," read "*Dr. Whewell.*"
Page 114, for "Ware Fox," read "*Were Fox.*"
Page 136, for "Buckhardt," read "*Burckhardt.*"
Page 143, for "De la Rue," read "*De la Rive.*"
Page 144, for "Majorchi," read "*Majocchi.*"

GENERAL INDEX.

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